



The
ART
and
CRAFT
of
PAPER-
MAKING

*Step-by-step
instructions
for creating
distinctive
handmade paper*

SOPHIE
DAWSON

The ART and CRAFT of PAPERMAKING

In this informative, colourful book, a leading papermaking artist shows you how to make your own stunning handmade paper.

Clear, detailed instructions make it easy to master the skills and techniques of this intriguing craft. Precise equipment lists and more than 200 step-by-step photographs guide you from the selection and preparation of fibres to the final pressing and parting, drying and colouring of the finished sheets. Individual project ideas will help you apply these skills as you explore your own creativity.

Customise your paper with a range of special effects, including laminating, embossing, watermarking, embedding and collage. Tackle some of the more advanced techniques, and use your handmade paper in a variety of craft projects, such as paper sculpture, creating textiles, candle shades, prints or handmade books. An inspirational gallery of work by papermaking artists provides an exciting view of what can be achieved.

The Art and Craft of Papermaking is the ideal introduction to this fascinating pastime and to the wide range and versatility of handmade papers.

*The Art and
Craft of
Papermaking*



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Sophie Dawson

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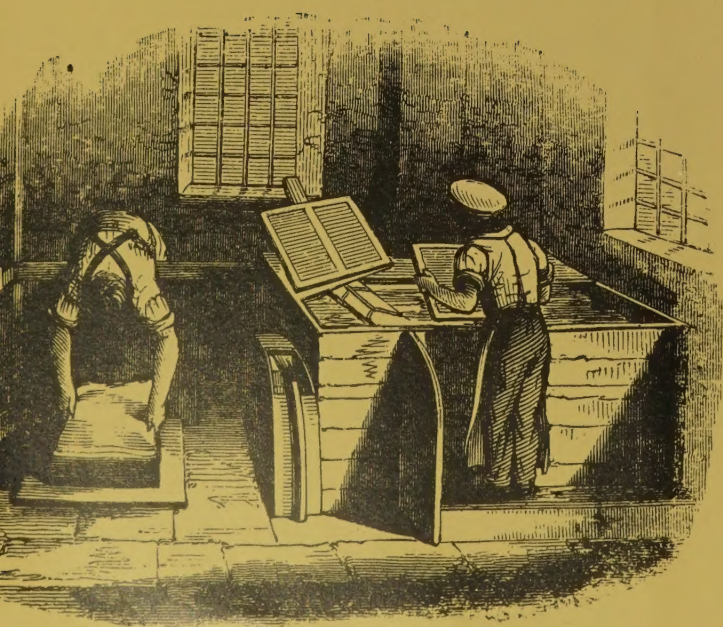
WARNING

A word of warning about dyes, pigments and other additives: Many chemical additives can be quite toxic and are poisonous if ingested or inhaled. Some can cause skin irritations. Precautions are, therefore, urged in dealing with any chemical compound. Good ventilation and the use of a mask are recommended when using powdered pigments; splash goggles and rubber gloves should also be used when mixing stock solutions. The use of a skin guard (barrier cream) may also be appropriate.

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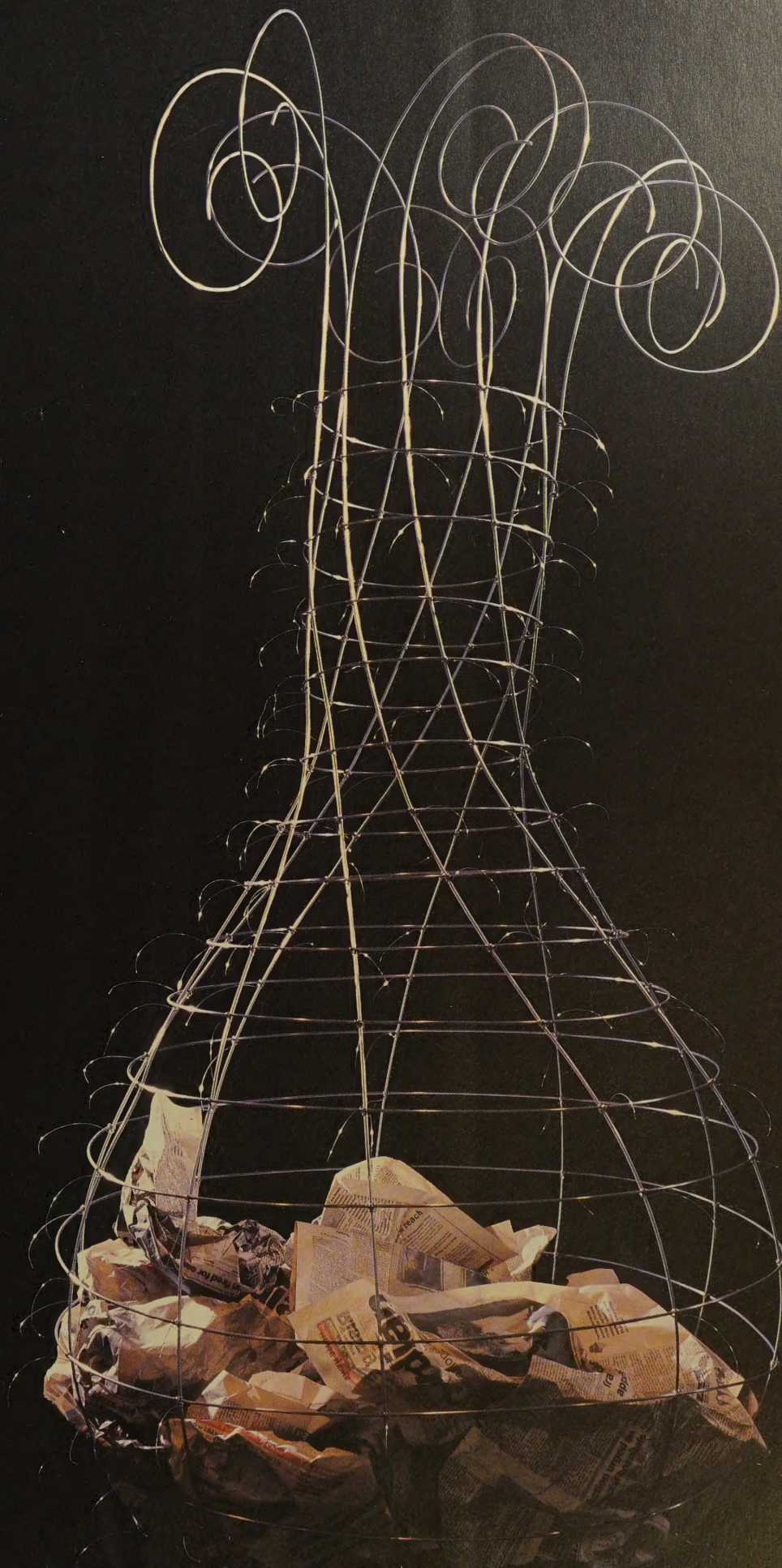
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Introduction



*Julia Manheim:
Guardian Angel.*

*Front pages of
The Guardian
newspaper and
wire, (right).*



Paper can assume many forms, and the practice of papermaking along with its historic uses in various cultures have been remarkably different. Paper has been respected as a sacred material in the East and simultaneously been employed there for a variety of utilitarian purposes, from making firecrackers to floor coverings. In the West, a more generally pragmatic approach to paper was adopted. This was largely due to the timing of its introduction to Europe, a millennium after its invention in China. It was predominantly used for writing, printing and wrapping in the form of newspapers, book papers, pictorial illustration papers, banknotes, artists' papers and wallpapers.

With the advent of industrialization,

paper lost the inherent features of a finely hand-crafted material. Paradoxically, the technology that made its mass production possible — the invention of chemical bleaching and acid sizing and the use of ground wood pulp — became a severe threat to the permanence of paper. Its role as a unique surface for writing, drawing, painting and printing has been further undermined by the advance of electronic communications media: paper has become one of the great disposables of contemporary society.

A reaction against mass production and a greater ecological awareness has, however, led to a renewed interest in both Oriental and Western methods of

hand papermaking. On the one hand there has been a gradual revitalization of the craft and a reaffirmation of traditional methods. On the other, there has been an unprecedented level of direct experimentation by artists from a variety of disciplines, who have extended paper's aesthetic role far beyond the limits of its accustomed use.

ANCIENT PRECURSORS

The search for a material capable of transmitting and preserving written information has led to a great variety of solutions. Some were temporary measures, others were meant to ensure permanence. Stone, metal, wood, waxed tablets, and clay tablets with their own



Egyptian sarcophagus of Rameses III (below right). Chinese "spirit money" is burned at funerals to placate ancestral deities (right). Josephine Tabbert: Lager aus Archäologischer (detail). Handmade paper (left).



clay envelopes were used in many ancient civilizations. These were gradually replaced by flexible alternatives that were cheaper to prepare and less cumbersome to transport.

Papyrus, made from a plant of that name, was the chief writing material in Egypt and the Graeco-Roman world for almost 4,000 years. It was used for literary and administrative documents, receipts, petitions, private and official letters. Our word “paper” derives from the Greek “papyros”, in turn probably borrowed from Egypt.

Parchment, made from the treated skins of goats and sheep, was developed by the Persians as an alternative to papyrus. It was more durable and flex-

ible than papyrus and was used for works of literary or religious importance.

Palm leaves and birch bark were the commonest forms of writing material in India and Southeast Asia, where bamboo and wood were also used. Palm leaves were the easiest to process into a suitable form for writing and were bound together into books by a cord threaded through the middle of each leaf.

THE INVENTION OF PAPER

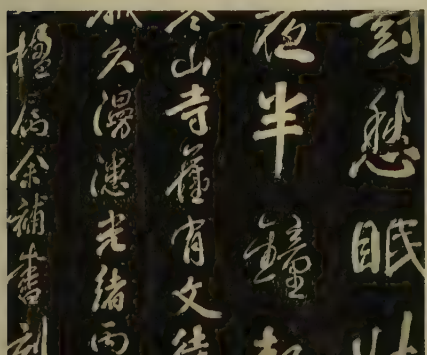
Paper was invented by the Chinese during the Han dynasty (202 BC-220 AD). Its “discovery” in AD 105 is credited to an Imperial court official named T’sai Lun. Prior to the development of paper, writing had generally been on bamboo

slips or pieces of silk. Bamboo was heavy and awkward to transport and silk was expensive, so paper, being lighter and cheaper to produce, was a welcome replacement. Paper was initially of poor quality, made from tree bark, hemp remnants, rags and fishing nets. But as papermaking methods were refined, it became an accepted and favoured writing surface.

The value placed on learning and literature in Chinese culture created an enormous demand for writing materials. Paper served the administrative needs of China’s developing bureaucracy and later became the means of economic management with the issue of paper currency.



Ancient writing materials include papyrus (below) and palm leaves which were used for books in Central and South East Asia. A modern use of palm leaves – Puck Bramlage: Key-Book, (left).



Ink rubbings, taken from stone inscriptions, were made possible by the invention of paper during the Han dynasty (left).



Kite paper is remarkable for its strength and flexibility, demonstrated in the early kites used for martial purposes in China and Korea. Festival, ceremonial and fighting kites are a colourful element of holiday celebrations.

Paper also played a prominent part in Chinese religious practices. Ornamental papers fashioned in the form of symbolic objects were burned at Chinese funerals, and paper representations of Buddhist and Taoist gods were pasted onto walls to protect the home from misfortune.

THE DUAL ROLE OF PAPER

The art of papermaking was a closely guarded secret for almost 500 years. It was introduced to Japan through Korea at about the same time as Buddhism, early in the seventh century. As in China, paper was used for the copying of sutra,

or Buddhist sacred texts. In AD 770 the Empress Shotoku commissioned one million printed paper prayers (*dharani*), each enshrined in a miniature wooden pagoda, to be distributed to Buddhist temples.

The use of paper as a sacred material was readily incorporated into many Japanese Shinto ceremonies. Paper was often used as a symbol of purity and had a spiritual significance that was an inseparable aspect of daily life. Paper ornaments and small strips of paper are still used as talismans and are hung up to mark sacred places.

Paper also had many aesthetic and functional uses. It began to be decorated, dyed, patterned, and to appear in more and more varieties, while the number of utilitarian products made from it also increased. In Korea, for example, paper was oiled to make floor coverings, lacquered to make chests, and used as sails for boats.

The strength, translucency and flexibility characteristic of *washi* (Japanese handmade paper) enabled an astonishing number of secular uses. Paper was not only used for writing, calligraphy, books, and printing with coloured woodblocks, but it was also made into fans, umbrellas, bags, banners, masks, kites, lanterns, tarpaulins, clothing, and sliding screens (*fusuma*) and windows (*shoji*).

THE MIGRATION OF PAPER

During an attack on the city of Samarkand in central Asia in AD 751 the Arabs are reported to have taken many Chinese prisoners, some of whom are

Tobacco pouches (right) made from thick, oiled paper to resemble leather. To emboss the striped pattern on the left-hand pouch, the paper was probably dampened and then pressed into a carved woodblock.



Woodblock prints depicting scenes from the life of the Buddha were frequently used as frontispieces for Chinese Buddhist works, and clearly reveal their Indian origin.

Parchment, made from the prepared skin of animals, and the finer quality vellum, provided a fine smooth writing material and superseded papyrus and wax tablets (right).



said to have been papermakers. From Samarkand the art of papermaking spread throughout the Islamic world. Important manufacturing centres were established in Baghdad, Damascus and Cairo, and by the ninth century paper was preferred to papyrus and parchment as a writing material.

Paper was available in Europe, as an expensive import from the Arabs, several hundred years before its manufacture in



local mills. At this time Europeans were using parchment and its finer equivalent, vellum (made from calfskin, lambskin or kidskin), but as elsewhere, once paper became a local product, it displaced these more expensive materials. The European paper industry started in Spain, where recent research shows there were important manufacturing centres at Cordoba, Seville and Xativa. By 1276 the craft of papermaking had reached Fabriano, Italy. It spread slowly through Europe during the 14th and 15th centuries, and in 1690, the first paper mill was established in the then British colonies of North America.

THE CHANGING FACE OF PAPER

Although the earliest uses of paper in the West were primarily religious, (Christian

manuscripts, votive images of the life of Christ, indulgences for pilgrims) the increase in literacy that accompanied the Renaissance and the decline in power of the Church put a different emphasis on the role of paper.

The development of new printing processes, notably the invention of a movable typeface by Johann Gutenberg (c 1446), advanced paper's importance in the publishing of books and periodicals. New illustrative methods, such as woodcut, engraving, etching and mezzotint, extended the aesthetic use of paper in printed images.

The imperatives of an expanding commerce created a huge demand for quality paper to be used for certificates, diplomas, deeds, banknotes and receipts as well as book publishing, while cheaper grades were required for wrapping and packaging. The versatility of paper was demonstrated in 17th- and 18th-century England as an increasing number of mills began to manufacture varieties of card and board for papier mâché, japanned ware and playing cards, which were made from sheets of paper pasted together. Rising demand, the development of new types of paper, and a growing realization of the profitability

An antique laid mould and deckle from the oldest existing (13th century) paper mill in Amalfi, Italy, (below).



Japanese folded paper fans (above) were probably first made during the 12th century. The flat uchiwa fan also became an indispensable popular accessory, and both are still in widespread use more than 800 years later.



Engraving (1700), depicting the interior of a paper mill (right), showing a set of water-powered wooden stampers used for pounding and refining the rags, the vat, couching and press.



of papermaking led to the emergence of a major industry.

CHANGES IN MANUFACTURE

In the course of its migration to Europe, the materials and production methods for making paper changed. These changes kept output in line with demand and satisfied the requirements of its end use. Paper was initially made by pouring pulp onto a woven cloth that was stretched across a wooden frame. The newly formed sheet was removed from the cloth only after it had dried, and many such moulds were needed to produce a useful quantity of paper.

Production was increased by the development of a mould with a removable bamboo or reed grass cover, which allowed the paper to be transferred and dried off the mould. The Japanese used

this to develop their own unique method of making paper called *nagashi-zuki* (see page p. 18).

Paper made from kozo and gampi, the inner bark fibres used for papermaking in Japan, was well suited to calligraphic writing with a soft brush and compared quite favourably with hemp-based paper from China and Korea.

Old cotton and linen rags, and hemp fibres from ropes and sailcloth provided the raw materials for Western papermaking and, following improved Middle Eastern methods for pounding fibres, a water-driven stamper was devised to beat and defibre the cloth. Writing with a European quill pen and oxgall inks required a different surface from that needed in the East. Therefore new methods of sizing and finishing the sheets were introduced to produce a

smoother, harder and more opaque paper.

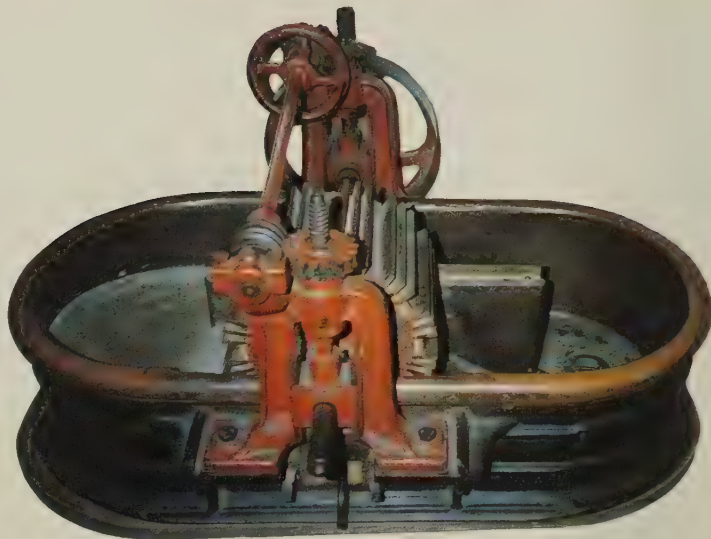
Further changes were also made to the construction of papermaking moulds. It is likely that early Spanish and Italian papers were made on moulds which closely resembled those used in Eastern papermaking. In Europe, however, there was no suitable natural substitute for the Eastern materials, such as bamboo, or thin strips of dried grass. The art of drawing metal into a slender thread or rod by hand is thought to have been practised in Italy at the beginning of the 12th century, and metal wires, possibly made of copper, soon replaced earlier materials. The configuration of closely spaced parallel "laid" lines held together by vertical stitching threads, or "chain" lines, remained essentially unchanged until the introduction of the

European “wove” mould in the mid-18th century. Both mould covers differed considerably from their Eastern counterpart in that they were permanently attached to the mould frame.

During the 17th century, Holland took the lead in paper production and the quality of Dutch paper was highly regarded. The Hollander beater, designed towards the end of the century and named after its country of origin, represented a significant advance in mechanical methods of refining rags for papermaking.

While these improvements made paper production more economical and led to its quantitative growth, the supply of rags could by no means equal demand. The shortage of raw materials generated an extensive search for alternative fibres and precipitated the change to wood pulp as the basic raw material for Western papermaking in the 19th century.

In the 17th century, a new mechanical device for beating pulp was invented in Holland. It is now widely known as the “Hollander beater”.



MECHANIZATION

Until the end of the 18th century, all paper was made by hand. But with the invention by Nicholas Louis Robert in 1798 of a papermaking machine that could in principle form an indefinite length of paper, and the development of the larger and more powerful Foudrinier machine in England a few years later, the ancient traditions of a hand craft were transformed into a modern industry.

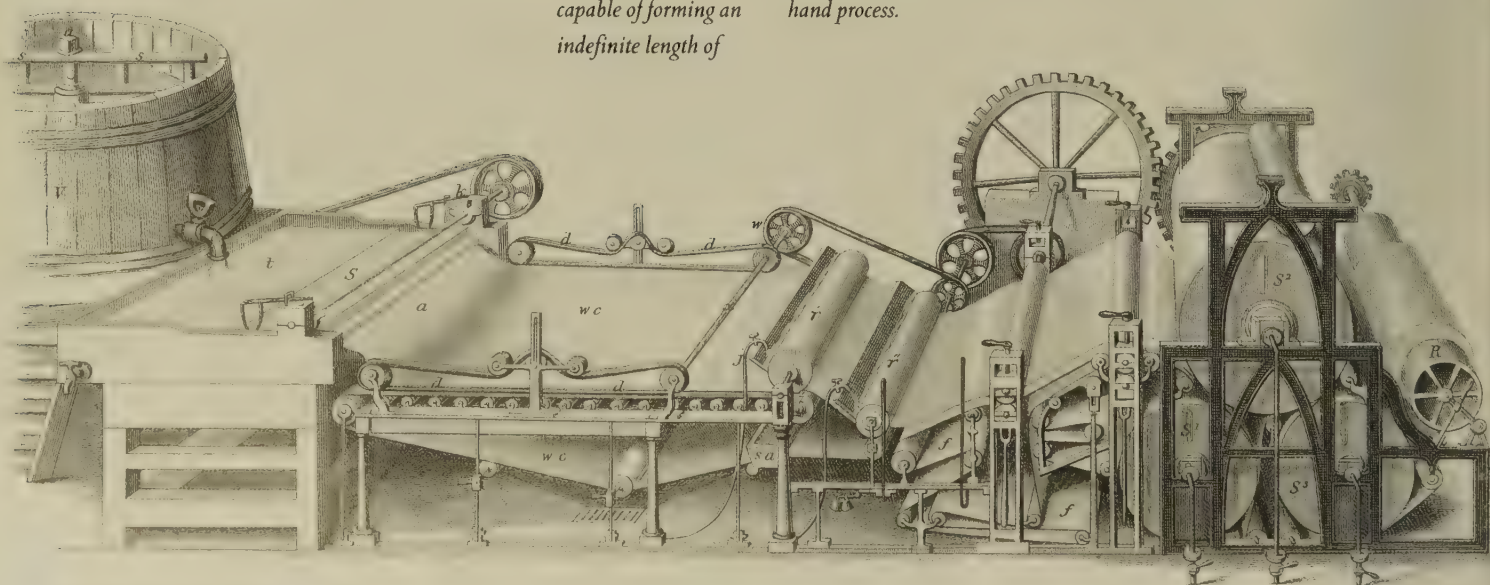
In the Foudrinier method, paper is

manufactured by pouring pulp onto a moving, continuous wire screen. Most of the water immediately drains away. The newly formed web of fibres is transferred onto a felt which supports the paper as it passes under a series of rollers which press out more water. The paper then passes over heated drying cylinders. Calender rolls give the paper a smooth surface finish, before it is finally reeled up.

When the first factory for machine-made paper was established in Shanghai, China, in 1892, the history of paper returned to where it had begun almost 2,000 years earlier.

A 19th-century papermaking machine with three drying cylinders, capable of forming an indefinite length of

paper and imitating mechanically all the operations that are performed in the hand process.



A CONTEMPORARY ART MEDIUM

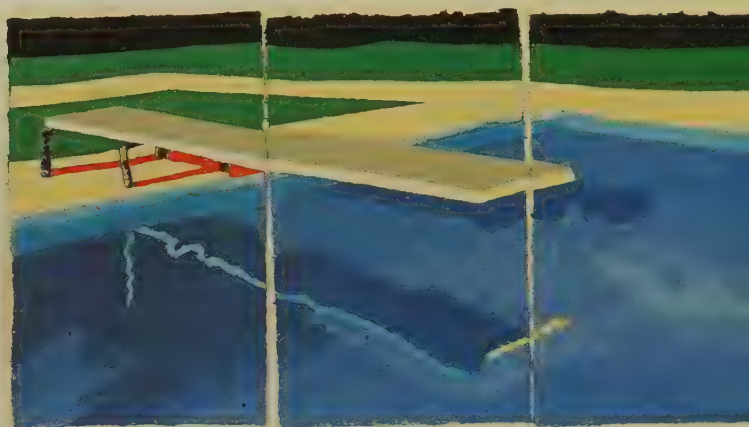
Artists have always concerned themselves with the characteristics of paper — its weight, texture and tone — as an integral part of their work. Today, however, artists have recognized the potential of the material as a medium in itself. The tremendous versatility of paper pulp accounts for much of its current popularity. It can be cast for sculpture; manipulated by hand like clay; burnished like metal or embellished with gold and silver leaf; vacuum-formed; sprayed, poured, daubed or spattered like paint; spun into thread and woven for textiles; sawn like wood or carved like stone.

Others are interested in paper as a medium for opposite reasons. Paper can quite simply be itself, and the process of making it need not imitate other techniques. The naturally structured procedures of making paper by hand have engaged and inspired many artists, regardless of their background discipline. The gathering of the raw materials, the preparation and beating of the fibres, the decisions that determine the final appearance of the sheet — its colour, surface texture, translucency, softness or strength; the almost instantaneous moment when the pulp settles on the surface of the mould; even the drying of paper offers a further possibility of allowing the paper to assert its own original expression.



Alan Shields: Rain Dance Route. Relief screenprint, woodcut (left). As an innovative printmaker, Shields came to regard paper as a medium as well as a support. He has constructed brilliantly coloured lattices with his prints.

David Hockney: Paper Pool (No. 31) (right). David Hockney made a group of paper works of swimming pools in collaboration with Ken Tyler at Tyler Graphics, New York, in 1978.



Julia Manheim: Fallen Idol (left). For this sculpture, Manheim used a combination of Soviet Crisis newspapers and steel wire.

Getting Started



*Japanese "rakusui"
paper made with
leaves embedded
between the
layers (right).*



During *nagashi-zuki* sheetforming (right), the papermaker gradually laminates a thin sheet of paper by repeatedly sloshing the vat mixture across the mould's surface.



Papermaking – East and West



A European vatman (above) dips the mould into the vat once and pulls it out, laden with pulp, before quickly shaking it from side to side and back to front to even the sheet.

Paper is made from the cellulose found in plant fibres, which are literally beaten to a pulp and dispersed in water. Forming the pulp into a sheet of paper is accomplished with a “mould” and “deckle”. The mould is a rectangular wooden frame, over which a porous screen or cloth (the mould cover) is stretched. The deckle is an uncovered frame which fits onto the mould. It forms a raised edge around the screen that prevents the pulp from running off the mould during sheetforming. A sheet of paper is formed by dipping the mould and deckle into a vat containing the pulp mixture and picking up a small quantity of pulp on the surface of the mould. As the mould and deckle are lifted out of the vat, the water drains through the screen and a layer of interlaced fibres settles on the mould – a wet sheet of paper is formed.

There are two distinct methods of hand papermaking, one Western and one Eastern. Both are centuries old. Both have remained essentially unchanged. The Japanese defined the difference between the two methods, calling the Western technique *tame-zuki*. This translates roughly as “the fill and hold way to make paper”. Traditional Japanese practice, which characterizes the Eastern method of making paper, is called *nagashi-zuki*. This translates roughly as “the flowing or sloshing way to make paper”. Each term describes the method used to form a sheet of paper. A third traditional approach, based on ancient Chinese practice, is called the “floating mould” method. It is still used by papermakers in Nepal, Bhutan and other Himalayan countries.

Both Eastern and Western techniques can appear complicated, but the basic

workings are not difficult to grasp. The process of hand papermaking has been adapted, throughout its history, to suit local conditions of manufacture. With a little practice, and perhaps by modifying a particular technique to suit your own skills and requirements, you can start to explore the dramatic range of visual and tactile qualities of handmade paper.

BASIC EQUIPMENT

Never let the lack of conventional papermaking equipment prevent you from getting started. With a little improvisation, readily obtainable tools and materials can be adapted to suit your purpose. Some of the earliest methods of making paper, which might seem primitive when compared to contemporary processes, resulted in the most beautiful and enduring examples of handmade paper. As you progress from the basic techniques to more advanced procedures, you will be able to determine the future scale and focus of your papermaking requirements and invest in equipment and supplies accordingly.

To make your own paper you will need:

- a mould and deckle
- a source of fibre
- a device for beating your fibre into a pulp
- a clean water supply
- a vat or container for holding the diluted pulp.

If you already have a kitchen blender and plastic washing-up bowl, you need only construct a simple rectangular wooden frame and attach a sieve-like surface to it to begin a simple papermaking operation.

WATER SUPPLY

A supply of fresh water is essential for any papermaking venture. Each step of the process — soaking the fibre, rinsing, cooking and beating it, through to sheet-forming — involves the use of water. You should, therefore, equip your work space to deal with a certain amount of spillage. Tap water, whether hard or soft, should be clean and, wherever possible, free of contaminants. If you want your paper to last a long time, it is best to determine the composition of your water supply (your local municipal water authority will be able to tell you what minerals are present), and to purify it if necessary. You can buy an inexpensive test kit (used for

aquariums) to check the acidity and alkalinity of the water. Mineral and organic residues tend to migrate to the surface of the paper as it dries and will precipitate quite visible staining. If you are making paper with an anticipated short life, you may not need to worry about purifying your water system.

THE VAT

The container which holds the prepared pulp is known as a vat. A serviceable vat can be adapted from virtually any container — for example, a plastic washing-up bowl, cat litter or catering storage tray. Even a kitchen sink with a suitable drainhole cover will suffice. Sheet plastic can be used to line a temporary unprimed vat. The vat should be a few inches deeper than the shorter side of your mould and deckle. Its inside dimensions should allow room to manoeuvre the mould and deckle with enough space for your hands on either side.

Basic equipment for making your own paper includes a mould and deckle, a

vat, a liquidizer, a sieve, couching felts and pressing boards.





The frame for nagashi-zuki sheet-forming consists of a ribbed mould; a flexible screen surface, or su; and the deckle which is hinged to the mould.

Mould and deckle



A simple mould can be made by using pre-cut canvas stretchers as a frame. A wide variety of screen materials is available for the mould cover.

The mould and deckle is the paper-maker's chief tool. Although its construction differs according to each particular sheetforming method, its function remains the same: to enable the water to drain away from a thin deposit of pulp that then becomes a piece of paper.

Japanese papermaking moulds are called *sugeta*. The *su* is a removable, flexible screen, usually made of thin, closely spaced, parallel strips of bamboo held together with fine silk threads. The *keta* is a lightweight, hinged wooden frame that holds the *su* in place. Ribs on the lower frame support the *su* and, on larger *keta*, two handles are fitted across the upper frame.

A traditional Western mould is made to withstand the weight of a larger amount of pulp and water than its Oriental counterpart, and is therefore a

sturdier construction. There are two types of Western moulds: "laid" and "wove". A Western laid mould resembles the Japanese *sugeta*, but the screen cover is permanently fixed to the mould frame and is made out of thin wire rods. The closely spaced, horizontal (laid) wires are similarly held together with more widely spaced perpendicular chain wires. A system of wooden ribs also supports the mould cover, but the deckle is not hinged to the mould. Paper made on a laid mould is called laid paper. It can be distinguished by the ribbed pattern of horizontal and vertical lines caused by the laid surface of the mould.

A wove mould refers to any mould with a woven mesh surface. The earliest mould was probably a simple frame with a coarsely woven cloth stretched across it. A Western wove mould covering now consists of a finely woven bronze wire

cloth. The wove paper it produces usually has a smoother surface appearance than laid paper.

MAKING A MOULD AND DECKLE

If you have some basic carpentry skills you can make a mould and deckle using the method illustrated on p. 22. However, a simple alternative is to use cut-to-size canvas stretchers. They are usually sold in pairs of equal length. You will need two identical sets of two matching pairs for a complete mould and deckle. To construct the lower mould, fit the pieces together and check to see that the corners are square. Fasten the corners with brass panel pins or small screws. Rub down any rough or uneven surfaces with a fine sandpaper. Assemble the pieces for the deckle in the same way as the mould. Waterproof with sealer.

The deckle determines the shape and thickness of the sheet and can be made accordingly. You can make a sheet of paper without a deckle, but the pulp will flow off the edges of the mould and result in a less well formed sheet. Pulp which slips under the deckle during sheetforming is responsible for the characteristic “deckle” edge of handmade paper. An adhesive closed cell foam strip, such as draught excluder or weather stripping, can be taped around the edges of the underside of the deckle for a closer fit on the mould.

The mould must be covered with a screen surface. Suitable materials include net curtaining, silk-screen mesh, window screen or mosquito mesh. Hardware cloth can be used to support a finer

mesh fabric such as nylon window screen, which tends to sag otherwise. Heat shrinking polyester mesh and brass screening can be ordered from paper-making suppliers. The screen surface should be fine enough to allow the fibres to remain on the surface and the water to drain through. If you choose a nylon, such as net curtaining, which tends to stretch when it is wet, you will need to wet it before stretching so that it dries taut.

A European wove mould made from mahogany with a fine yet strong phosphor-bronze screen surface. A division stick for the deckle allows two sheets to be made at a time.



PROJECT

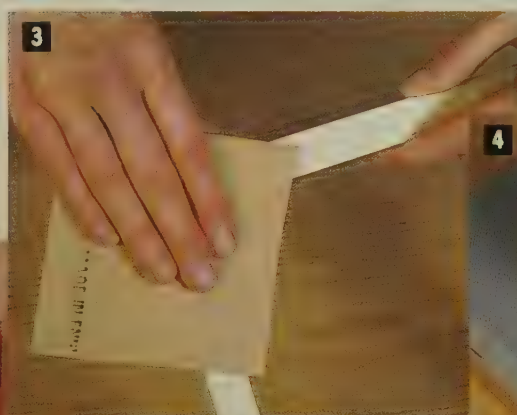
Making a mould and deckle

2 Glue the corner joints with a waterproof adhesive and nail with brass panel pins. Brass L-

shaped corner plates with flathead brass screws will strengthen the corners.



1 To construct the lower mould, fit the pine lengths together. Use simple abutment, lap or dovetail joints. The correct inside measurement of the frame should be $8\frac{1}{4} \times 11\frac{3}{4}$ in (21×30 cm).



3 Rub down any rough or uneven surfaces with a fine sandpaper.



YOU WILL NEED

- 8 lengths of pine wood cut to size
- waterproof adhesive
- brass panel pins or small screws
- brass L-shaped corner plates (optional)
- waterproof adhesive
- waterproof sealer or linseed oil
- screen mesh
- stainless steel staples or brass tacks
- fine sandpaper

4 The mould must be covered with a screen surface. It must be stretched taut across the mould. Stiff mesh should be cut to the same size as the mould or just within the outside edges. Net curtaining should be stretched over and around the outside edges before it is stapled. Using staples or tacks, work from the middle of each opposite side towards the corner edges.

5 Apply a waterproof adhesive tape around the edges of the screen, over the staples to prevent pulp from being caught under the screen mesh.

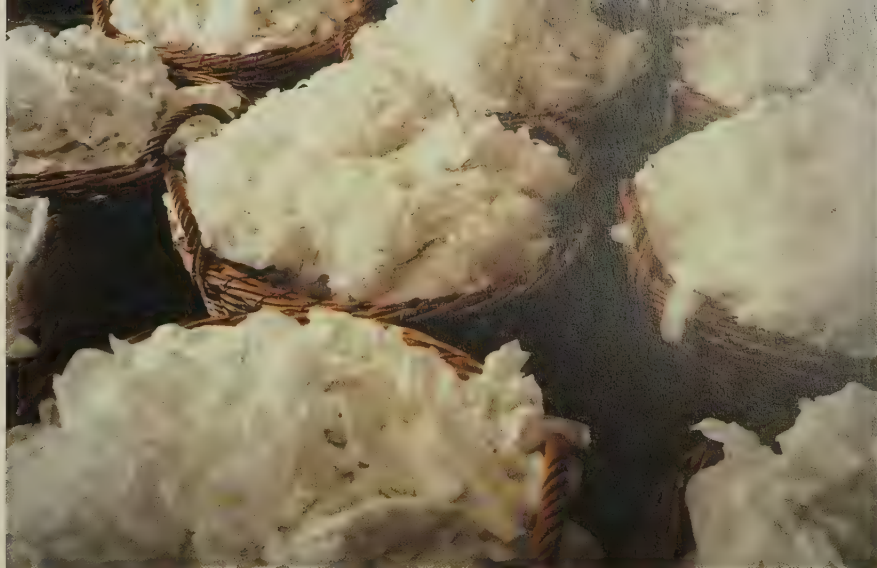


6 Assemble the deckle pieces in the same way as the mould. Use a penetrating waterproofing sealer or a light coat of linseed oil on both the mould and the deckle.

7 The deckle fits neatly over the finished mould ready for use.



The long staple fibres of the cotton plant are removed by a process called "ginning" and used to make cloth. Cotton rags produce a very strong, durable paper.



Sources of Fibre



Leaf fibres with a strong outer skin must be scraped, or decorticated, to remove the skin and release the inner fibres.

Cellulose fibre, the main ingredient of paper, is available in a number of different forms. All living plants contain cellulose, but some yield a higher percentage of usable fibre than others. Some fibres are long and slender, while others are shorter and thicker, and there may be different length fibres within the same plant.

Paper can be made from almost any plant, but those with a high content of long cellulose fibres generally provide the best source. It is also possible to use fibre that has previously been processed and used for another purpose. Your choice of fibre will be determined by the kind of paper you want to make and the equipment you have for processing it.

Raw fibres for papermaking are classified according to their location in the plant. Bast or inner bark fibres, such as hemp, flax and kozo, contain some of

the longest fibres for papermaking. Leaf-stem fibres, such as abaca, and leaf fibres from plants such as sisal and yucca offer a comparatively shorter range than bast fibres. Grass fibres include such plants as bamboo, bagasse (sugar cane stalk) and rice straw. Grass fibres produce the shortest and most brittle fibre for papermaking, and the amount of usable fibre is relatively low.

A further category of fibres are attached to the covering around the seeds of certain plants. Cotton and kapok are familiar examples of "seed-hair" fibres. Finally, there are fibres from both softwood and hardwood trees, which are used for industrial papermaking.

PREPARED FIBRES

Fibres used in textile- and basketry-making are often suitable for making paper. Cloth made from flax and cotton



Dry bundles of Japanese bast fibres (below left): kozo, gampi and mitsumata. The bark needs to be soaked overnight to soften it prior to cooking. Harvesting flax fibres (left) from which linen cloth is produced. Flax can be used to make exceptionally strong, translucent paper. Cotton (below right) is a strong, versatile fibre which provides an exceptionally pure form of cellulose.



was the traditional source of fibre for Western papermaking. "Half-stuff" (partially prepared cloth scraps from the textile industry) is perhaps a more common source today. Processed fibres, such as raffia, seagrass, jute and sisal, are often sold by craft and weaving suppliers for textile purposes. Other partially

processed fibres include cotton linter, which comes in several grades, and abaca. These are available in the form of dry, compressed sheets.

An alternative source worth considering is recycled paper pulp. Paper has a long history as a recycled material, and today many artists believe in using waste papers as part of a wider environmental policy. Industrial and commercial papers provide a readily available source, but they should not be used indiscriminately. Papers with either a heavily coated or glossy surface, or those treated with a hard surface size (which renders them less absorbent) are difficult to break down without prolonged soaking or cooking. Poor quality, short-life papers, which contain a large percentage of wood pulp and are highly acidic, will produce an inferior recycled paper. If high standards are required, the best papers for recycling are quality hand-made or mouldmade rag papers.



Rice straw has long been used as a material for papermaking in China. The piled straw has been treated with lime to release the fibre.



Preparing the fibre

Most fibres require some kind of treatment before they can be used for making paper. This usually involves cooking the fibre in an alkaline solution and, sometimes, a pre-cooking stage, depending on the nature and form of the fibre.

The methods used to prepare linen and cotton rags for early European papermaking were quite extensive. Before the cloth could be used, the effects of spinning the cellulose fibres into threads and weaving the threads into cloth had to be undone. This was a time-consuming and labour-intensive task. The rags were first sorted and graded according to fibre, colour and quality, and any seams or buttons removed. After sorting, any loose dirt was removed and the rags were cut into smaller pieces. The rags were then put through a process of fermentation, which began to loosen and soften the

fibres for beating. This was followed by careful and thorough washing. Faster cooking and bleaching methods began to replace these traditional techniques during the early 19th century.

RAW FIBRE FERMENTATION

Raw fibres often require fermenting (also called retting) before, or in place of, cooking to render them suitable for papermaking. Fermentation can be achieved by soaking the fibre in an alkaline solution or just by leaving the fibre to stand in water in a warm place until bacterial action begins to loosen the fibre. This traditional technique is still used by the Chinese to prepare bamboo for papermaking.

The preparation of kozo, which represents 90 percent of the bast fibre used in traditional Japanese papermaking, also involves several preliminary stages.



Japanese bast fibres are steamed in wooden containers. Once the stems are cool enough to handle, the loosened bark is peeled off the woody core.

Kozo trees, a variety of mulberry, are usually harvested after two years of growth. The stems, which are about ½ in (15mm) in diameter, are cut into even lengths, bundled and steamed in a closed container for two hours. The steam causes the bark to shrink back from the wood core, which can then be easily stripped away. The stripped fibre is hung to dry and stored for future use.

Before it can be used for paper-making, the dried fibre has to be softened, and it is left to soak in cold running water, usually a nearby stream, for several hours. Quite often, the bundles of soaking fibre are trampled under foot, which loosens the black outer layer. The fibre is then taken to a dry work area and the black outer bark is scraped off the damp strands with a knife. If a fine white paper is desired, the secondary green bark is also removed, leaving only the white inner bark for paper-making. The cleaned fibre is then washed to remove any specks of bark. It

is either dried and stored again or taken directly to be cooked.

COOKING

After preparation, raw fibres usually need to be cooked before they can be properly beaten into a pulp. The aim of cooking is to liberate and purify the fibres and dissolve unwanted parts of the plant. Lignin (the intercellular “glue” which binds the fibres together as the plant grows), for example, is undesirable because it rejects water and impedes the bonding of the cellulose fibres, which are attracted to each other in water. Other extraneous material, such as sugars, starches, waxes and gums (called “extractives”), must also be removed. Their presence will contaminate the pulp and can cause the sheet to discolour and deteriorate with age.

The objectives of cooking are best achieved using a mild alkaline solution. In the past, Japanese papermakers used a potash made by leaching water through

wood ash (potassium carbonate), and sun-bleaching was often used to lighten the colour of the fibre before beating. The bark is cooked for several hours, depending on the age and quality of the fibre and the kind of paper being made. After cooking, it is washed thoroughly to rinse the alkali from the fibre. Each strand is then examined for any remaining impurities and carefully picked clean.

COLLECTING AND COOKING

Finding local plant sources is a rewarding aspect of making your own paper. You might well discover in your area relatives of plants that have already been identified as a proven source of paper-making fibre.

Most plant fibres are harvested in the late summer or early autumn, or at the end of the growth cycle, when the cellulose content has reached its peak and before the plant has begun to dry out. Just as the fibre from each plant species differs, fibre from a single plant can also vary according to seasonal climate, conditions of growth, age, the time when it is harvested, and the method used to process it.

If you decide on a particular plant, try picking it at different times of the year. Use it green or allow it to dry before cooking it to produce a subtle range of texture and colour variations in your finished paper.

HOW MUCH TO COLLECT

The amount you collect will depend on the availability of the fibre and how



Sorting, grading and cutting rags, which arrived at the mill jumbled together in all sorts of conditions, was an unenviable task usually carried out by women.



Weighted bundles of bamboo are left to soak as part of the lengthy fermentation process required to prepare the fibres for papermaking.

much paper you want to make. Some fibres contain a higher volume of fibre than others. Yucca, for example, is easy to harvest and the leaves of the plant yield a high proportion of fibre, but some reeds which would seem to provide a strong fibre, only yield small quantities of short fibres after cooking.

Surprisingly large quantities of raw material are needed to produce a useful amount of pulp from plants with a lower yield. It is better to start with a small amount of fibre, and find out how successful it is, before you collect in bulk.

COOKING TIMES

Cooking times will vary according to your choice of chemical. The chemicals used in the cooking process affect the characteristics of the finished paper. A strong caustic solution, or prolonged cooking, can result in damaged fibres and a weaker paper. Some fibres take less time to cook than others and tougher

fibres may require longer cooking.

If a fibre is not sufficiently cooked after two hours, it may be best to cook it a second time. Strain and rinse the fibres and make a fresh alkaline solution for a further two-hour cook. If a fibre fails to cook sufficiently after four or five hours, it is probably advisable to try fermenting it first.

It is important to note that herbaceous bast fibres, and some of the tougher leaf and grass fibres, usually need a fair amount of preparation. Some are resistant to cooking and, in addition, require prolonged beating, whether by hand or machine, to produce a suitable material for papermaking. Such fibres are better

METHYLCELLULOSE

Methylcellulose comes in powder form and is water soluble. It can be used as an archival, mild glue and is often added to short fibre pulps to increase bonding for casting. Make a stock solution of methylcellulose with 16oz (454ml) of water and 8oz (227g) of powder. Add the powder to the water gradually, stirring the solution as you do so. Leave until the powder has dissolved completely. Dilute the stock solution as required.

FORMATION AID

Formation aid, also called *neri* or synthetic *tororo-aoi*, is available from papermaking suppliers and comes in a powder form. The powder should be mixed with cold water using 2tsp (4g) of powder to 1 gallon (4 litres) of water. Fill your mixing container with water and add the powder slowly, stirring it as you do so. Leave the solution for several hours, stirring occasionally, to ensure that the powder dissolves completely.



Dry, field-retted leaf fibres can be harvested in late autumn and will not need to be scraped before cooking. Cut the leaves into small pieces and soak them in clear water for 24 hours.

prepared by using fermentation techniques (see p. 25).

THE CHEMICALS TO USE

Soda ash (sodium carbonate) is considered a standard cooking chemical. It is a safer and more convenient choice than caustic soda (also known as lye). Soda ash, or washing soda, can be ordered from papermaking suppliers and most retail chemical suppliers. The washing soda that is widely available in supermarkets, as a cleaning product, is not always a pure form of soda ash. The following directions are for cooking plant fibres with pure soda ash.

COOKING INSTRUCTIONS

Having identified and collected your plant material, cut the stem or leaves into $\frac{1}{2}$ in (12mm) pieces. Remove any nodes, or joints, and discoloured parts. Pre-soaking the fibre can reduce cooking time. Dried plants should be weighed and soaked for 24 hours prior to cooking. Some plants (those with hollow stems, for example) may need to be crushed with a wooden mallet or rolling pin before soaking. Fresh plant material

should be weighed and soaked overnight.

The alkaline (soda ash) ratio can be determined according to either the dry weight of the fibre concentration, or the volume of water used to cook the fibres. For the dry weight method, an average of 20 percent of the dry fibre weight is recommended — 20 percent of 16oz (450g) of fibre, for example, is $3\frac{1}{2}$ oz (90g). However, since the volume of water determines the strength of the solution, this is a more accurate method of formulating the alkaline ratio. If you use this approach, begin with $\frac{1}{2}$ oz (15g) of soda ash to every quart (litre) of water. You can raise the concentration to 1oz

(30g) per quart (litre) depending on how difficult the fibre is to cook. The pH value of the cooking solution should be between 10 and 11 in order to eliminate the undesirable non-cellulose constituents yet leave the cellulose unharmed. Use a pH test strip to check the balance.

Fill a stainless steel or enamel cooking pan with enough cold water to cover the fibres. Weigh the required amount of soda ash and dissolve it in a beaker of water. Add this to the water in the pan. Stir the solution well and bring it to the boil. Add the fibre when the solution begins to boil.

Bring the fibre and cooking solution back to the boil and then reduce the heat to simmer. Time the cooking from this moment. Cover the pan and cook for 2-3 hours in a well-ventilated area, stirring the fibre every 30 minutes. Check the fibre at the same time by removing a small amount and rinsing it. Then try to pull it apart along the grain. The fibres are cooked when they separate easily with a gentle tug.

Let the cooking solution cool and then strain off all the spent liquor,

Once the fibres are cooked and have been drained, rinse them thoroughly under clear running water making sure that all the fibres are cleaned of contaminants.



preferably using an outside drain. Rinse the fibre thoroughly until the water runs clear. Use a deep sieve with a fine nylon or non-corrosive mesh, or line a colander with a fine mesh fabric, and always wear rubber gloves when draining and rinsing the fibres. It is essential to remove all traces of the exhausted chemicals and any vestiges of lignins and other non-fibrous constituents. The simplest method is by repeatedly washing the drained fibre in a bucket, using several changes of fresh water. This should reduce the pH of the fibre to almost neutral (pH 7). You can check this balance by dispersing a small amount of fibre in a beaker of distilled water and taking a reading with a pH test strip. (Available from companies specializing in library supplies.)

BLEACHING

Plant fibres have their own characteristic colours and rarely need bleaching. Several traditional methods of fibre preparation, however, have the effect of lightening the fibres, which can enhance the qualities of the finished paper. In Japan, for example, hanging stripped fibres outside to dry exposes them to the natural bleaching effect of sunlight, and in Europe the routine procedure of washing during beating was once a common method of lightening rag fibres.

The introduction of chlorine and its use as a bleaching agent at the end of the 18th century quickly replaced older, more time-consuming methods of whitening rags without chemicals. Chlorine

A 3 per cent solution of hydrogen peroxide can be used to lighten fibres with less risk of degradation than from other chemical bleaching agents. Before bleaching (right) and after (below).

SAFETY CONCERNS

- Wear gloves and eye goggles when mixing chemical solutions.
- Never use aluminium containers

or stirring utensils with alkalis.

- Always add the alkali to the water and never the other way round.
- Avoid skin contact

with solutions and work in a well-ventilated area.

- Always read safety precautions and follow manufacturer's instructions.



can, however, seriously degrade cellulose fibres and alter the pH balance of paper, causing it to become yellow and brittle with age. If you do wish to lighten the natural colour of your fibre, hydrogen peroxide is the safest chemical bleaching agent to use. Steeping the fibres in a dilute solution for several days after cooking will cause them to brighten gradually. Optimum bleaching takes place in a solution with a pH balance of between 9.0 and 9.5. Hydrogen peroxide will not leave a harmful residue on the fibre, but you must wash the fibres thor-

oughly after bleaching. The pH should be close to neutral.

STORING FIBRE

Dried plant fibres can be stored indefinitely, but make sure that they are kept dry and do not mildew. Cooked and washed fibres may be covered with water and kept in a refrigerator for a week, and sometimes longer. Check the fibres at regular intervals to see that they have not spoiled. Cooked and washed fibres should not be dried for future use, but they can be frozen.

A set of water-powered stampers at the Richard de Bas papermill in France. These were used for pounding and refining rags in water-filled troughs.



Beating and pulp preparation



A Hollander beater filled with pulp. Hollander beaters cut and lacerate fibres, producing a different quality pulp from that produced by the rubbing and fraying of stampers.

How you beat your fibre will have a significant effect on the quality and characteristics of your finished sheet of paper. The aim of beating is twofold: to hydrate and fibrillate the fibre. Hydration refers to the alteration of the cellulose fibres as they absorb water during the beating process. Fibrillation refers to the bruising of the fibre walls and unravelling of the fibrils — the smaller fibre components of the fibre. Both effects promote the chemical bonding (known as hydrogen bonding) between the cellulose fibres that is necessary to make a sheet of paper.

Shortening the length of the fibres through cutting is an optional effect of beating. A certain amount of cutting can be useful, particularly with longer fibres which may clump together to create a wild or unevenly formed sheet of paper. Too much cutting, however, will

produce a paper without suppleness or strength.

The early European method of beating prepared rags into pulp was by using large, waterpowered trip hammers, or stampers. These were replaced during the late 17th century by the Hollander beater, which was not only faster but could produce pulp from unprepared cloth.

Today there are several types of Hollander beater, but all of them work on the same principle: the pulp circulates around an oval-shaped tub, which is divided in the middle. A powered roll with fixed metal bars across it (rather like the paddles on a paddle-steamer) is situated midway down one side. As the roll rotates, it pushes the pulp down one side of the tub, where it passes between the roll and a bedplate, which is fixed in the tub floor beneath the roll. The pulp

is thrown up and over the backfall, around the back turn, up the opposite side, around the next turn, and so on. The fibres are continually beaten against the bedplate by the roll bars until they are turned into a pulp.

Beating methods and beating times are determined by the nature of the fibre and the type of paper required. In Japanese papermaking, relatively little beating is needed, and beating continues only until the fibres are loosened. This is because the bast fibre contains a high percentage of hemicellulose, which is similar to cellulose in composition but more easily plasticized.

BEATING BY HAND

Hand beating is the simplest and most direct method of turning plant fibres into a suitable pulp for making paper. The original Chinese method of beating fragments of cloth or bark into a pulp was by pounding with a pestle in a mortar. You can adapt this method for most plant fibres, using an implement such as a wooden mallet, a baseball bat or

the flat edge of a piece of hardwood, and beating the fibre on a solid piece of hardwood or granite block. Even the flat end of an axe-handle in a strong bucket will suffice. Soak any wooden implement and wet the board before you start beating to help prevent the wood from splitting (for this reason, do not use a domestic chopping board).

If you adapt a pestle or mortar from a smooth stone or river rock, make sure that pieces do not chip or flake off into your fibres while you are beating them. Some fibres have a tendency to splatter as they are beaten. If you are beating on a flat surface, you may wish to make a splatter guard around your beating area. It is advisable to wear goggles.

Take a small quantity of cooked fibres, squeeze out the excess water and place on a sturdy beating surface. Beat the fibre by moving systematically across the pile. The fibre will begin to expand under the force of each blow. As the pile spreads out across the beating surface, stop and fold the edges in towards the centre. Then turn the mass of fibre



Plant fibres can be beaten by hand using a wooden beating stick (left), as in this illustration from Kamisuki Chohoki (above).



A Hollander beater (designed by Peter Gentenaar) folded open to reveal the roll and bedplate. This model is made for processing long fibres such as flax.

upside down and repeat the procedure. If the fibres appear to be drying out while you are beating, sprinkle a small amount of water on them so that they can properly hydrate and separate.

TEST FOR READINESS

To determine whether the fibre is sufficiently well beaten, add a small amount to a jar of fresh water and shake vigorously. If there are any large strands or clumps of fibre, continue beating.

USING A BLENDER

A kitchen blender offers a quick and easy alternative way of preparing some plant fibres, although you may wish to continue the process of preparation by hand methods and reserve the use of a blender for recycling paper. Place a small handful of prepared fibre into the blender jar and fill it with water to a level approximately 2in (5cm) from the top. Run the blender for an initial 10–15 seconds. Watch carefully to ensure that the fibres do not become entangled in the blades and listen for any sound of strain on the motor. Make sure that water does not enter the motor. If your blender has variable speeds, start with a lower one and

increase the level according to the stage of fibre separation. You will put less strain on the motor by running it in a series of short bursts than a single longer one. Remove the lid and check the fibre between each burst. Never leave the blender running unattended or allow it to overheat.

Remember that a blender, because of its purpose, will separate and shorten the fibres by cutting them. A blender cannot completely hydrate or fibrillate the fibres. Each time you “recycle”, or liquidize, a fibre, its length is shortened and the finished sheet will be consequently weaker. Hand beating rarely results in over-shortened fibres.

RECYCLING PAPER IN A BLENDER

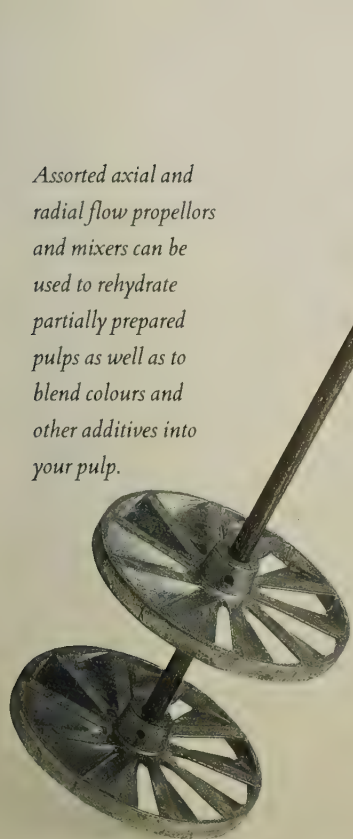
Whatever type of recycled paper you choose (see below), make sure that any pieces of adhesive tape, gummed edges, staples or paper clips have been removed. Tear or cut the paper into 1in (2.5cm) squares or smaller pieces. Soak them in water overnight. If the paper is not absorbent, you may need to soak it for longer or use boiling water. Rinse the pieces after soaking.

Waste papers — especially rag paper which has been heavily sized, or paper which has already been used for writing, drawing or printing — can be cut into pieces and then cooked in a mild alkaline solution to clean and soften the

Plant fibres can be beaten by hand using a small, heavy pestle and mortar, or a wooden mallet on a broad solid surface.



Assorted axial and radial flow propellers and mixers can be used to rehydrate partially prepared pulps as well as to blend colours and other additives into your pulp.



fibres. Rinse the pieces again before processing in the blender.

If you are using an acidic source material, such as glossy magazine paper or newsprint, and are concerned about the permanence of your paper, you will need to use calcium carbonate (a pure form of limestone) as an alkaline buffer. Soak the pieces overnight in a solution of $1\frac{3}{4}$ oz (50g) of calcium carbonate per quart (litre) of water.

To prepare your pulp, take a small handful of paper pieces and drop them, one at a time, into the blender jar about two-thirds filled with water. Blending times will vary according to how smooth or textured you wish the paper to be.

Liquidize printed paper for a relatively shorter time if you want to preserve parts of the image or text.

Other mixing devices, such as a Whiz-mixer (a propellor-like blade on the end of a long motor-driven shaft), can be used to make larger quantities of pulp from partially-prepared fibres in sheet form.

STORING BEATEN PULP

Leftover, beaten pulp can be drained, stored in a covered container and refrigerated. If the weather is cool, you may be able to leave the pulp in a bucket for several days. Cover the bucket with a fine mesh or porous cloth to stop insects

Small batches of plant fibres can be processed using a kitchen blender (right and below). Do not liquify completely or you will have a weak, brittle paper.



Beat the fibres (above) until they are reduced to an equal fineness when shaken in a jar of clear water.





or dust settling on the pulp. Like any other vegetable material, it will spoil if left for too long.

You can leave leftover, beaten pulp to air dry, once it has been drained. Use a fine sieve or net straining bag and squeeze as much water as you can out of the pulp. When you need to use the pulp again, soak it in water until it softens. You may then need to remix it to eliminate any undissolved lumps. However, once the pulp has dried it will never reabsorb the same amount of water, and may produce a weaker paper.

COLOURING AND OTHER ADDITIVES

A wide range of natural substances — including berries, barks, plant juices, soot, saffron, molluscs, madder, woad and indigo — were used to colour early papers. Various methods were used to apply the colour, such as brushing it onto the surface of the paper or dipping the sheet into a dye bath.

Early European handmade papers reflected the colour and quality of the rags from which they were made. The principal colours were shades of white, brown and blue. The best rags were selected for white paper. This was available in several grades and was used for writing and printing. Blue and brown rags, for the most part, produced a range of coarser, but strong, serviceable papers, which were used for wrapping and for decorative papers and wallpapers.

By the 18th century, the addition of colourants to the pulp — following the principles of textile dyeing — had

A subtle range of papers can be produced using the natural colours of different plant fibres.



Water-dispersed pigments are made specifically for paper pulp to give rich and vibrant colours.

extended the range of coloured paper. Dyes are water-soluble colouring agents. They usually penetrate the structure of the fibres in order to become attached to them. Dyes have a natural affinity for cellulose. The most frequently used include: direct dyes (organic dyes usually derived from coal tars); fibre-reactive or procion dyes (which form a chemical bond with the fibres in an alkaline solution and are often used in the textile industry); and natural dyes derived from plant sources.

Few dyes are entirely colourfast, lightfast or bleedproof when used alone, and you need to be careful over selecting the most suitable dye-stuff. Dyes which require an acid mordant (colour-bonding substance) to fix them onto cellulose fibre should be avoided. A book dealing specifically with the use of textile and natural dyes will advise you on preparing the correct dye-stuff for your choice of papermaking fibre.

Pigments are insoluble, finely ground

particles which either coat the fibres or fill the spaces between them. The only truly lightfast colourants, they produce clear, bright shades of colour and are chemically inactive. However, pigments have little affinity for cellulose and must be held onto the fibre by means of a binder. Pigment and binder are usually added to the pulp during the final stage of the beating process. A range of aqueous-dispersed pigments (dispersed

in a concentrated form in water), specifically formulated for the colouring of paper pulp, are available together with the necessary retention agent, from papermaking suppliers, and come with full instructions for use. The retention agent is designed to help bond the dye to the fibres in place of an acid mordant.

BRIGHTENERS AND FILLERS

Certain additives, such as calcium carbonate, kaolin (China clay) and titanium dioxide, can be used to improve the opacity and brightness of paper. They usually come in fine powder form and are added to the pulp at the end of the beating cycle. Like pigments, they become entrapped between the fibres and can be used as a "filler" to improve the surface smoothness of a sheet for printing, or to reduce shrinkage in three-dimensional paper techniques.

A selection of Japanese coloured papers.



A shallow pool of water is used as a vat in Nepal. A sheet of paper is formed by pouring the pulp into a mould floating on the water.



Vats



Early Western vats resemble large wine casks with metal hoops around the wooden staves.

The vat or tub which contains the prepared pulp for papermaking has changed over time and according to the method of sheetforming and shape of mould being used.

One of the oldest vats in Eastern papermaking is a shallow rectangular trench or well dug in the ground and filled with water. The mould (a wooden frame with a woven material stretched across the bottom) is floated on the water, which fills the bottom of the frame. The papermaker squats beside the vat and forms a sheet by pouring a measured amount of pulp into the mould, levelling the pulp by deft movements of the hand before carefully lifting the mould from the vat.

Most Eastern methods now employ a rectangular wooden vat, raised to a convenient standing height. This is filled with water to which the beaten fibres are

added. The vat is large enough to accommodate the mould and the action needed to scoop up the pulp and form a sheet of paper. Vat attachments for traditional Japanese vats include a *maze* (mixer): a removable rake-like device suspended above the vat for distributing the fibres evenly throughout the vat, mould support sticks and a mixing stick.

In the earliest depictions of European paper mills, the vat is often a large, round wooden tub (although the moulds were rectangular), and was probably made from a huge wine cask. Later illustrations show the “pistolet”, or heating device, which warmed the water in the vat, and a bridge or platform which extended across the vat and supported the “horn” against which the mould was placed to drain prior to the couching of the freshly formed sheet. Production vats were later made of stone

or iron (lined with lead to prevent rust). Their design included a “knotter”, which filtered the knots or other impurities from the pulp, or stock, before it entered the vat; and a “hog”, a rotating paddle device at the bottom of the vat which kept the stock in suspension.

Wood (pine and cedar) lined with copper or stainless steel sheeting, concrete (sometimes lined with ceramic tiles) and marine fibreglass are used to build contemporary production vats for Japanese and Western papermaking. They usually follow a rectangular design, with the front wall slanting towards the bottom, and include many of the traditional vat accessories.

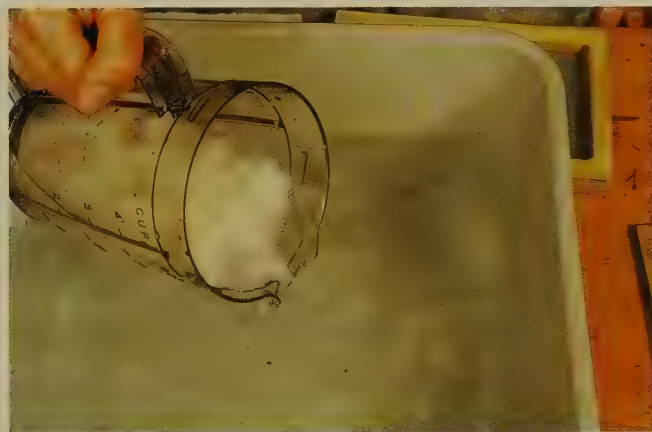
FILLING THE VAT

To make a sheet of paper, you must first dilute your prepared pulp with fresh water in a vat. The thickness of a sheet is determined by the proportion of pulp to water. A good ratio to begin with is one blender jar of pulp to four of water. You can, either, half fill the vat with water and add a blender jar full of pulp, stirring in extra pulp until you reach the desired consistency, or you can pour the pulp from the blender into the vat first, adding water to dilute it. When you are filling the vat, leave a sensible distance of about 3in (8cm) from the top, otherwise the pulp and water are liable to splash over the sides as you make the sheet.

Each time you make a sheet you remove a certain amount of fibre from the vat solution. You will need to replenish the vat with more pulp as the mixture becomes thinner. Keep a bucket of reserve pulp near your vat and, draining a jugful at a time through a plastic sieve, add extra pulp to the vat as required.

Most pulp has a tendency to settle at the bottom of the vat. Each time you make a sheet, stir the vat mixture gently to distribute the pulp evenly throughout the vat. Wet the surface of your mould before you make your first sheet and then position the deckle on top of it.

You will have to experiment with the ratio of fibre to water, but you will soon be able to judge the consistency, and vary it according to how thick or thin you want the paper to be.



A short length of bamboo makes a useful stirring stick to keep the pulp in suspension (below).



The papermaker in Japan works on his own, compared to the operation of a vatman and coucher in the West.



Sheetforming and couching



After the paper has been formed and the deckle removed, the coucher transfers the sheet onto a felt. A slightly curved couching surface helps to facilitate the transfer.

The standard Western method of forming a sheet of paper involves adding the pulp, or “stuff”, to a vat of clean, fresh water. The fibre content in the vat is about one or two percent. The sheet of paper is formed by a man or woman known as a “vatman”, who holds the mould and deckle above the vat and dips it into the suspension of fibres. With a steady, uninterrupted movement, the vatman brings the mould and deckle up out of the vat in a horizontal position. He or she quickly shakes the mould slightly, from side to side and back to front, as the water drains through the screen surface. The action sends a ripple of pulp in both directions. It helps to even the surface of the pulp and to interweave the settling fibres. The vatman rests the mould on the side of the vat to drain, then removes the deckle and passes the mould to a colleague known

as the “coucher”. The vatman replaces the deckle on a second mould (a pair with the first) and continues to make another sheet of paper.

COUCHING

The process of transferring a freshly made sheet of paper onto another surface is called “couching”. The term comes from the French *coucher*, meaning to lay down. Couching allows multiple sheetforming with a single mould. In Western papermaking, each sheet is couched onto a damp blanket called a “felt”. A stack of freshly couched sheets of paper, alternated with felts, is known as a “post”. A post usually consisted of six quires (a quire contained 24 sheets). Today, a post contains 50–100 sheets, depending on production requirements.

The coucher takes the first mould from the vatman and props it against a

small post, called an “asp”, to continue its draining. He or she then inverts the mould, with the freshly made sheet adhering to it, and presses it against a damp felt, transferring the new sheet of paper from the mould onto the felt. The coucher returns the mould to the vat, covers the couched sheet with a second felt, and takes up the second mould from the vatman ready for couching.

Nagashi-zuki sheetforming is quite unlike the Western practice. Besides the mixture of fibre and water, a clear mucilaginous extract, called *neri*, is added to the vat. Neri is derived from the roots of various plants, *tororo-aoi* (a variety of hibiscus) being the most common. The use of neri is unique to Japanese papermaking. It gives the water a certain viscosity, which slows the drainage of the vat mixture through the su (see p. 20) during the sheetforming process, and it acts as a formation aid by preventing the

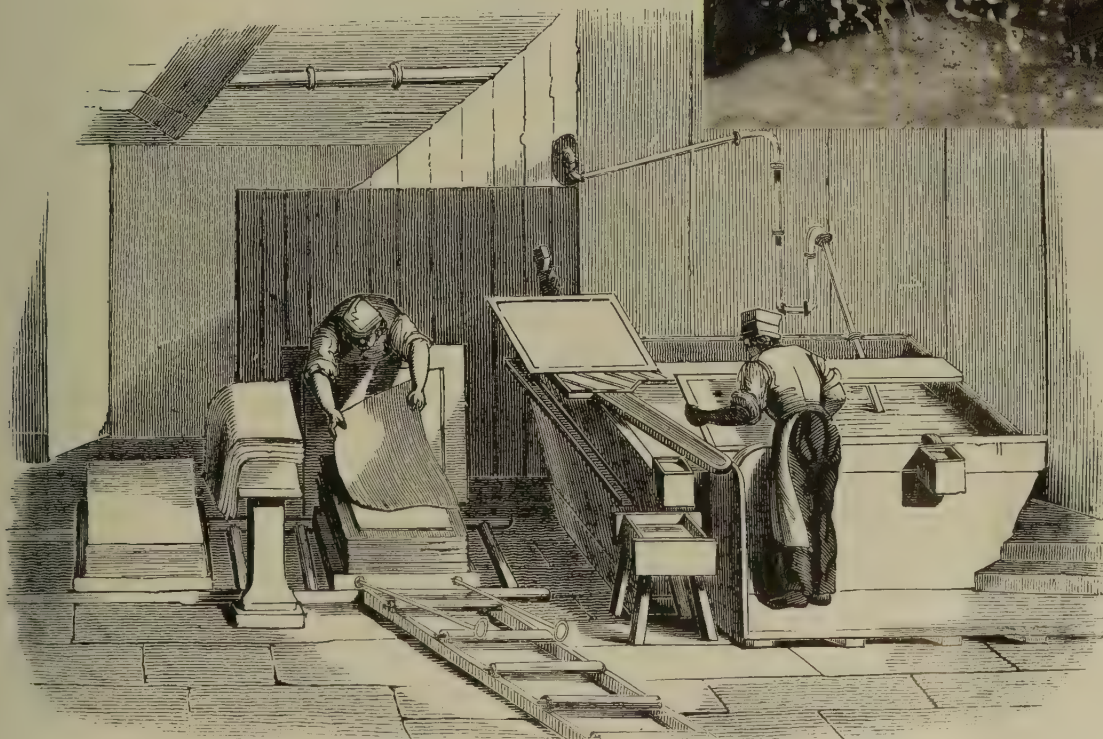
long bast fibres from becoming entangled.

The papermaker dips the front edge of the mould, the *sugeta* (see p. 20), into the vat and scoops up a small amount of the fibre and neri mixture. He quickly tilts the mould so that the solution rushes across the *su* and off the far side of the mould. He immediately scoops up another “charge” and sloshes the mixture

back and forth, and sometimes from side to side, across the *su*. As the water drains away, he may toss off the excess pulp before dipping the mould again. This process is repeated several times, gradually accumulating layer upon layer until the appropriate thickness is achieved.

To couch the sheet, the papermaker opens the hinged deckle and carefully removes the flexible *su*. He turns to a

Kathryn Clark forming a sheet of handmade paper at Twinrocker, USA. As the water drains through the surface of the mould, it is dexterously shaken from side to side and from front to back to even the sheet.



The rhythm of the vatman, who makes the sheet, and the coucher, who transfers the freshly made sheet onto a felt, establishes the production of the vat.

table behind him, and having rotated the screen so that the newly made sheet faces the couching surface, he lines up one edge and gently lowers the su across the surface until it lies flat. He then picks up the near edge of the su and carefully peels it away in a continuous movement, leaving the new sheet behind. He returns to the vat with the su, and continues to make a second sheet. He couches each new sheet directly on top of the previous one, without an interleaving felt. Some-

times a thread is laid between the sheets – about ¼in (6mm) from the near edge – which serves as a marker to facilitate the parting of each layer after the post has been pressed (see p. 44-7). After a day's papermaking, a nagashi-zuki post can contain 250 to 500 sheets.

CHOOSING AND USING FELTS

Felts are an important part of Western papermaking. They support the paper when it is couched and help to facilitate

the removal of water when the sheet is pressed. The texture of the felt will be impressed onto the sheet of paper and can be used to produce a distinctive surface pattern on the finished sheet of paper. Traditional papermaker's felts are 100 percent woven wool and are extremely absorbent. However, they are prohibitively expensive when new. Suitable alternatives are: old woollen blankets, cotton diapers, and various non-woven or synthetic materials, such

TECHNIQUE

Forming your sheets



1 The mould surface must be uppermost and the deckle is placed on top.



2 Hold the mould and deckle in a vertical position above the vat, with your hands on the shorter sides.



3 Dip the mould straight into the far side of the vat, bringing the bottom edge towards you.

as interfacing fabric (the sew-in variety). Thick sheets require heavier weight felts than thinner papers. Interfacing fabric is available in different weights and can be selected accordingly.

Having the correct amount of water in your felts will greatly assist the transfer of the sheet from the surface of the mould. The felts should be well dampened but not dripping wet. If you find the transfer is incomplete, the felts may not be wet enough. It is a good idea

to have two sets of felts, one for white paper and one for dyed pulp. Felts should be carefully washed after use and hung up to dry to prevent mildew.

COUCHING YOUR SHEETS

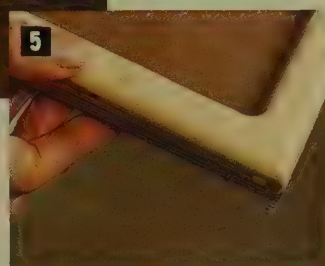
The process of transferring a newly made sheet of paper onto a dampened cloth, or felt, requires a little practice. Although your first sheets may be difficult to couch on a flat surface, you will find that the process (using a continuous

rolling movement) becomes easier as the post of sheets and interleaving felts assumes a natural curve. You can create a slightly rounded surface on which to start couching by folding several couching cloths into a small mound beneath the middle of the first felt. This should be carefully removed before the post is pressed (see p. 45-6).



4 As it reaches a level horizontal position, lift the mould straight up out of the vat in a single continuous movement, without hesitation. As soon as the mould is lifted clear of the vat, and while the water is draining, gently shake the mould from back to front and side to side. If you shake too vigorously, or

continue after the water has drained, the pulp will sludge up in the direction of the shake and the sheet will be unevenly formed. Pulp liquidized in a blender can drain quite quickly. Using a finer mesh surface on the mould will slow the drainage and give you more time to execute a proper shake.



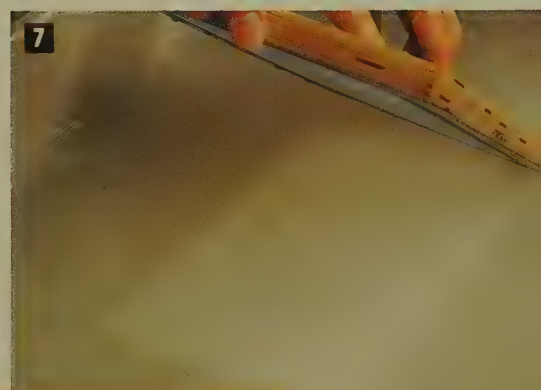
5 Hold the mould above the vat until the water has completely drained.

6 Rest the mould on the side of the vat, or a flat surface beside it, and remove the deckle carefully, making sure that no drops of water fall onto the wet sheet.



7 If the sheet is unevenly formed or damaged by drops of water from the deckle ("vatman's tears"), turn the mould face down and lightly

touch it to the surface of the water in the vat ("kissing off"). Stir the pulp back into the vat, dispersing the fibres evenly.



TECHNIQUE

How to couch

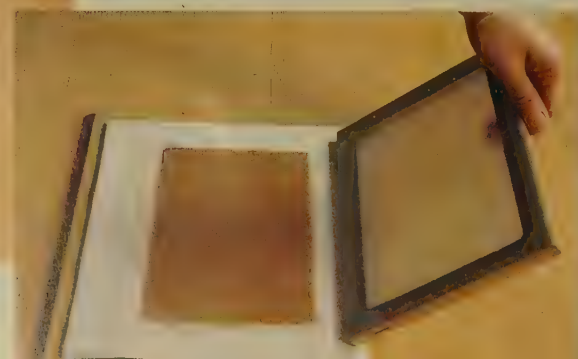
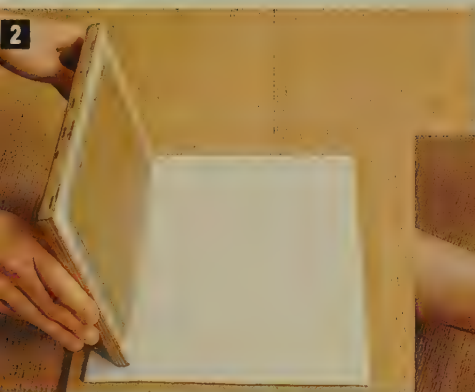


1 Couching should be done on a firm surface. A piece of board, about 4in (10cm) wider than your mould on all sides and suitably

waterproofed, will provide a good surface and can be used as a pressing board when you have finished couching. Your couching cloths

(felts) should be about 2in (5cm) wider than the four sides of your mould. If you are using a light- to medium-weight felt it is a good idea to put

a thicker cloth or several thinner layers underneath it to provide a receptive surface for couching your first sheet.



2 Hold the mould upright at the side of the felt and start couching from the longest edge, using a swift, firm rolling action across the surface of the felt. An uneven pressure, or

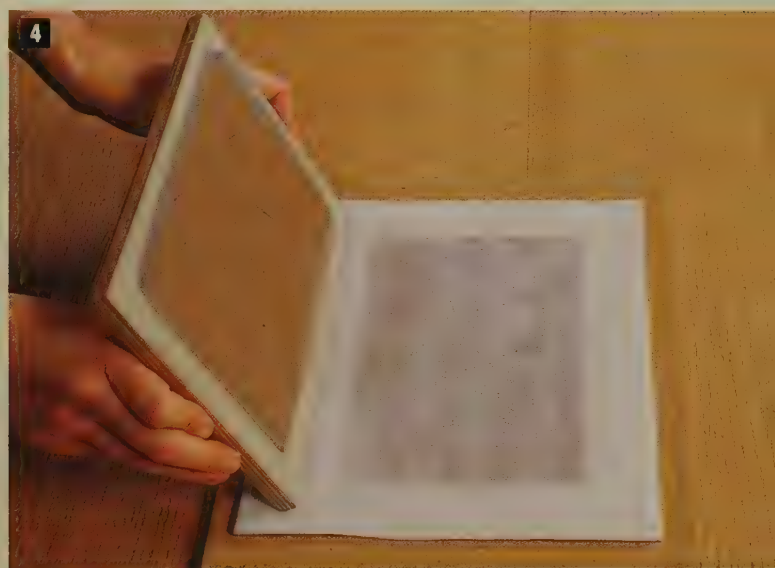
slight hesitation, can cause air bubbles to become trapped between the felt and the sheet and leave part of the sheet stuck to the mould surface.

3 Place another dampened felt on top of the couched sheet, ensuring that there are no wrinkles in it. Then make a second sheet of paper.



4 When this sheet has drained and you have removed the deckle, line it up along the same edge and couch it directly on top of the first

sheet. Cover the paper with a dampened felt as before and continue layering the wet couched sheets and dampened felts.



5 When you have finished couching, cover the top sheet with an extra felt. Place a second board, the same size as the base board, on top of

the pile. If you are using a lightweight couching cloth, cover your last layer with an additional, thicker cloth before you lay down the top board.



After pressing, the damp sheets of paper are separated from the felts by the "layer" and laid on top of one another against a sloping stool.



Pressing and parting



Pressing creates a physical bond between the fibres and starts the drying process.

After couching a quantity of sheets with alternating felts, the post (see p. 46) is taken to a press, where much of the water is expelled under considerable pressure. The function of the press is to remove as much water as possible before drying, and to help bond the fibres into a strong sheet. Traditional wooden screw presses were used for this task until more powerful hydraulic presses took their place.

As soon as the process of de-watering is complete, the post is removed from the press, and a third member of the papermaking team, the "layer", separates the felts and damp sheets. The sheets are laid carefully, one on top of the other in a "pack" against a sloping stool, and the felts are returned to the coucher for re-use. The sheets are frequently given a second, longer pressing with dry felts, using less pressure. They might then be

parted and re-stacked, or "exchanged" (see p. 49), without felts and pressed again several times. This further pressing diminishes the mark of the felts and smooths the surface of the paper.

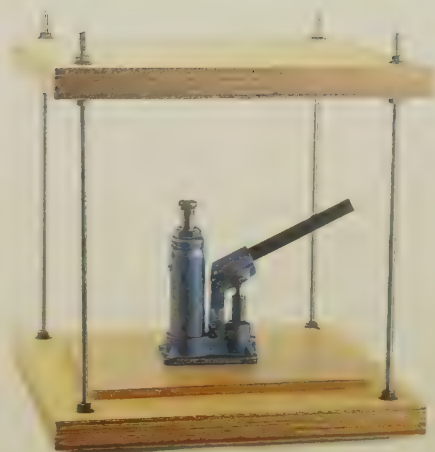
Early Eastern pressing methods consisted of a simple lever press hung with weights, or several large stones placed on top of the post of paper on a pressing board. The traditional Japanese way of removing the water from a post of freshly couched sheets of paper is far more gradual than the equivalent Western process. When sufficient sheets have been couched, the post is covered and left to drain overnight. The following morning, the post is pressed slowly for several hours under light pressure. The pressure is gradually increased in such a way as to remove the excess water without causing the sheets to stick together.

PRESSING AND PARTING PAPER

Pressing a wet sheet of paper can be done by one of several methods. Once the sheet has been transferred from the mould, you can place it between acid-free blotters or absorbent cloths, and sponge out the excess water by hand. Sometimes a rolling pin or mangle is used, but this can distort the wet sheet by forcing the pulp to travel in the same

direction as the water. A simple press, where an even surface pressure is applied on top of the sheet, or post of sheets, forces the water from the centre out towards the edges and reduces the possibility of displacing the pulp.

A heavy weight — such as a stack of evenly placed bricks, or a centrally placed bucket filled with water or sand



A home-built press (above) can be assembled using a small hydraulic jack, plywood boards, threaded rods with nuts and washers and

a small metal plate or piece of wood. Place this between the top of the jack and the bottom surface of the top platform to spread the pressure.



Massive wooden screw presses (left) were used to squeeze out as much water as possible from a post of freshly made sheets of paper.



With a 20-ton hydraulic jack, the Howard Clark press (above) is made of welded structural

aluminium and is capable of pressing sheets of paper up to 22×30in (55×75cm).

— can be positioned on top of your covered post. More weights can be added to increase the pressure gradually and force the water through the post. A substantial amount of water will be removed by pressing. Stand your press on a raised platform in a tray to contain the water as it is squeezed out.

A post need only be a small one, with perhaps 10–15 sheets to begin with. When building up a larger post, the

natural curve of the couched sheets becomes more pronounced. If the post is too large, and the curve becomes too steep, the sheets may be distorted during pressing.

MAKING A PRESS

You can make a simple press along the lines of a traditional flower press. Take two pieces of $\frac{1}{4}$ in (2cm) plywood or blockboard, cut at least 2in (5cm) larger

than your post of felts and paper, and protect them with several coats of polyurethane varnish. To achieve the necessary pressure, you can use two evenly spaced G-clamps on either side of the boards, or you can drill a hole in each corner of the plywood to accommodate a wing-nut screw or galvanized carriage bolt. Alternatively, you could make battens to place across the boards. Use four equal pieces of 2×1in (5×2.5cm) pine-



You can use a rolling pin to press the paper, but this can distort the wet sheet (below).



A newly formed sheet of paper contains about 90 per cent water. Pressing speeds the drying time and improves the quality of the sheet. There are several methods of pressing. You can place your paper between acid-free blotters, or absorbent cloths, and sponge by hand (left).

You can place a heavy weight on top of the covered post and gradually increase the weight (below).



wood, 4in (10cm) longer than the boards. Drill a hole in the middle of each end to take carriage bolts with nuts and washers that will tighten the press to the maximum pressure.

Greater pressure still can be obtained by using a traditional screw-operated book press. Or you could build your own mechanical press with the aid of a small hydraulic jack of the kind used for changing car tyres. Both methods will

speed up pressing and drying time considerably.

USING YOUR PRESS

Leave the post in the press for about half an hour. The bottom sheets and edges of the paper may still be wet if the post has not been pressed for long enough. Remove the post from the press and place it on a dry working surface. Lift the top felt or couching cloth off slowly.

Pick up each damp pressed sheet by carefully lifting the corners of the near long edge, or by lifting two opposite corners towards each other. If you find this too difficult at first, try lifting the supporting felt with the sheet still in place, taking care not to lift the sheet below.

You can transfer your post of paper and felts to a simple press.



After removing the post from the press, carefully separate each sheet from the one below by lifting diagonally opposite corners (below).



Screw down the carriage bolts (above). After about 10 minutes, give the screws a few extra turns to increase the pressure. Ideally,

pressing should be for about 20–30 minutes with gradually increasing pressure, or until all the excess water has drained through the felts.



In China, bamboo paper is left to dry on the ground after pressing, and it is not unusual to see whole papermaking districts literally covered with drying paper.



Drying the paper



After pressing, the Japanese papermaker brushes each one onto a smooth board to dry in the sun, or onto a heated metal sheet to dry indoors.

After pressing the still damp sheets were taken to an upper storey — the drying loft — and hung over horse- or cow-hair ropes coated with beeswax that stretched across it. Drying lofts were carefully ventilated by means of wooden louvers, which could be adjusted according to the humidity inside the loft and weather conditions outside.

Successful drying is best achieved slowly. Undesirable shrinkage and warping, or cockling, at the edges of the sheets can occur as the fibres themselves shrink laterally during drying. Hanging the damp sheets in “spurs” — several sheets lightly pressed together into a small pack — helps to lessen the distortion of each individual sheet as it dries. When the paper is completely dry — it may take a week or longer — the sheets are easily separated from the spur and can be stacked and lightly pressed to

reduce any distortion. In the past, a ridge of paper, known as a “back mark”, was often caused by the hair rope over which the paper was hung.

Various heating systems were introduced during the 18th century to speed up the process of loft drying. Modern papermaking machines have a “dry end”, consisting of drying cylinders and a set of rollers. The paper is passed, dried and smoothed between these, thereby solving the problem of drying paper quickly while maintaining its flatness.

Oriental papers are dried in various ways. The Chinese leave the sheets outside on the ground, and in Nepal they are left to dry on the mould, whereas in India damp sheets are sometimes brushed onto plaster walls. Japanese papermakers traditionally separate damp sheets from the post after pressing and brush them onto seasoned wooden boards to

dry outside in the sun. This often results in a subtle lightening of the paper. It is more usual today, however, for the damp sheets to be brushed onto a heated metal drying surface.

DRYING YOUR PAPER

Drying methods have a considerable effect on the surface and handling qualities of the finished paper. Sheets that are pressed and then dried on boards will be flat and smooth with a slightly different texture on each side. Sheets that are left to dry on the mould without pressing will also have two characteristic surface textures: the side which dries against the mould will be smoother than the outer side. These and similar methods, which resemble the Oriental model, are known as restraint drying.

RESTRAINT DRYING

If you have separated your post by lifting each felt and damp sheet together, you can leave the paper to dry on the felt – a simple form of restraint drying. Drying the sheet on the felt is, however, quite time-consuming. A quicker method is to place the felt, sheet side down, on a smooth, clean, flat surface. Sheet glass, Formica (conti board), perspex or wooden board are all suitable, but make sure that wood has been sealed or is well seasoned to prevent it from staining the damp paper. Roll the back of the felt gently but firmly with a small roller or rolling pin. Lift the felt carefully from the back of the sheet, leaving the sheet adhering to the drying surface. The paper should remain flat on the surface,

Drying lofts had ropes like washing lines, over which the paper was hung to dry. After drying the sheets are stacked under light pressure and “exchanged” regularly so that the air gets to the surfaces of all sheets.



without lifting or curling off, until it feels completely dry.

Lift a corner of the paper and peel it away from the board. If part of the sheet begins to pull away before the rest is dry, use a plant sprayer filled with fresh water to spray a fine mist over the entire sheet. Then reapply the sheet to the drying surface. Once removed, dry sheets can be stacked between boards and stored under a light weight, such as a covered brick or a heavy book.

EXCHANGE METHOD OF DRYING

If you have parted your damp pressed sheets from their supporting felts, transfer them onto dry felts, making sure there are no creases in the paper, and return them to the press for a slow pressing overnight. When you remove the sheets from the second pressing, stack them one on top of the other

without interleaving felts. Place a single dry felt at the bottom and top of the stack and press it again, more lightly, between the pressing boards. You can repeat this pack pressing several times, separating and restacking the papers each time, until the sheets are dry and the surface becomes quite smooth.

Alternatively, after the second dry felt pressing, the still damp sheets can be interleaved with acid-free blotters, cut to the same size as the sheets. Keep the post under a light, even pressure and exchange the blotters regularly for dry ones as they draw the moisture from the sheets. Once the sheets are completely dry, place them under a light weight and store them in a cool, dry room.

A DRYING BOX

As a variation on the blotter method you can make your own cabinet-style ply-

wood drying box, which uses the same sequence of layering as a traditional flower press. The box should be left open at the front and have a removable top. Interleave the damp paper with blotters but include additional packing material, such as a double-wall corrugated board, a porous foam or stiff screen mesh, at regular intervals as “spacers” between the blotters. Layers consist of spacer board, blotter, paper, blotter, paper, blotter, paper, blotter, spacer board, and so on — depending on the dampness of the sheets. Packing materials for drying sheets or low relief artwork in a paper dryer are available from papermaking suppliers.

Stack the post in the drying box, leaving a narrow gap as an air space between the back wall and the drying stack. Mount a small fan flush with the inside back wall of the box. This creates a current of air which draws the moisture out of the stack and speeds up drying time. The stack can be kept absolutely flat, either by the weight of the top board or by means of winch straps on opposite sides of the stack.

LOFT DRYING

Sheets which are not restrained during the drying process are more likely to warp or shrink. On the other hand, the fibres have a greater opportunity to bond

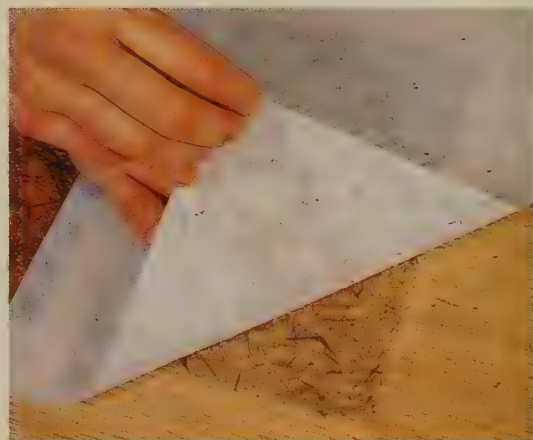
together as the sheet dries. This results in a strong sheet of paper with good folding strength. You can loft dry your sheets after pressing, by hanging them over a wooden clothes horse or length of plastic washing line.

DRYING TIME

Whichever method you use, drying times vary according to the weight, thickness and size of the sheets, as well as the surrounding temperature and humidity. Paper should always be dried slowly. Use a fan to keep the air circulating around the sheets rather than an artificial source of heat directly on them.



Having separated your sheet with its supporting felt from the “post” (left), lay it carefully on the drying surface (sheet side down) and roll the back of the felt (below).



Lift the felt from the back of the sheet, which will have adhered to the drying surface (above). Peel the sheet off the board when it has dried completely (right).



A mechanical method of imparting a smoother surface to paper by means of a glazing hammer soon replaced earlier polishing by hand.



Sizing and finishing

Until paper has been sized it is known as “waterleaf” paper. It is generally very absorbent if wetted again. Sizing makes waterleaf paper less permeable and is applied according to the end use of the paper. It reduces the bleeding or feathering of any water- or oil-based media applied to the paper’s surface. It can also improve the sheet’s smoothness and protect the fibres from dirt and pollution.

Traditionally size is applied to the sheet after it has been pressed and dried. This is called external, tub, or surface sizing. Common surface sizes are vegetable starches made from rice and wheat, and gelatin derived from animal tissue or bones. Nowadays, size is frequently added before the sheet is formed, either during beating or in the vat. This is variously termed internal, beater/engine or stock sizing. Two of the most commonly used internal sizing agents were alum

and rosin. However, their high level of acidity limits the life of paper, and a neutral pH liquid size (alkylketene dimer) is now more widely used.

Finishing is a term for the final processes that affect the surface texture of the dried paper, increasing its smoothness or gloss, for example.

Once dried, European handmade sheets were taken down from the ropes in the drying loft and loosened from one another if they had been dried in spurs, ready for sizing. Gelatin was the traditional ingredient of size, having replaced the starch size inherited from Arab papermaking. The size was prepared by boiling the assorted remains of slaughtered animals. The resulting gelatin was strained and diluted before use. Gelatin size (increasingly mixed with alum) was warmed in a sizing vat, and spurs of paper — about 50 sheets — were

The names “rough”, “not” and “hot-pressed” are used to describe the traditional finishes of handmade paper.

immersed in it. The spurs were assembled into a post of size-soaked paper and pressed to force the size through the entire post. Out of the press, the spurs were separated into single sheets and loft-dried as before. After this second drying, the individual sheets were stacked and pressed in a dry press, then restacked and pressed again before proceeding to the finishing treatment.

Hand methods of surface sizing and finishing continued in the West until the introduction, in the 16th century, of, first, the glazing hammer and later in the 18th century, mechanically-driven glazing rolls, which imparted a glazed finish to the paper as it passed between the rollers.

FINISHES

Handmade paper can have three basic finishes: “rough”, the surface texture of a sheet which has been pressed once between felts and dried without any fur-

ther smoothing or pressing; “not”, or “not hot pressed”, the result of parting the sheets from the felts and pressing them again without interleaving felts; and “hot pressed” or “HP”, a glazed surface that comes from passing the paper between hot metal plates or rollers.

Traditionally Japanese papers are not usually sized. When additional surface resistance is required for a particular printing technique, an animal hide glue and alum size is brushed onto the paper after it has dried. For special paper, a camellia leaf is sometimes used to shine the top side of the paper as it lies on the drying board.

SIZING AND FINISHING PAPER

The sizing method you choose will depend on how you intend to use your paper. Paper for printmaking, water-colour paper and calligraphy paper all require different amounts of sizing. A strong sizing application results in a

harder, less absorbent paper. A light sizing produces a paper which will show more feathering or “bleedthrough” of such media as paint and ink.

INTERNAL OR EXTERNAL SIZING

First you need to decide whether you want to size your paper internally — by adding a sizing agent to your pulp — or surface size it after it has been pressed and dried. In either case, there are several sizing applications to choose from. Neutral pH alkylketene dimer emulsion for internal sizing is available in a concentrated form from most papermaking suppliers. It simply needs to be diluted with water and added to the pulp during the last few minutes of the beating or mixing cycle.

Contemporary papermakers have experimented with a variety of internal and surface sizes, including gelatin, household and vegetable starch, methylcellulose and acrylic and silicone sprays.



Dissolve a measured amount of gelatine in hot water.

Pour the solution into a shallow tray.



Immerse the sheets of paper in the size.

Some substances, such as alum and rosin size, cause the paper to discolour and are best avoided. Rice or wheat paste and gelatin sizing can make paper prone to insect or fungal attack in humid conditions. Others stiffen the paper by “gluing” the fibres together, but do not increase the surface stability for writing.

Surface sizes are applied to dry “waterleaf” paper. If you can, leave your sheets to mature for several weeks before sizing them. The dimensional stability of the sheet will be increased and the paper will be less likely to disintegrate in the sizing solution. The size can be brushed or sprayed onto the paper, or the sheets can be tub-sized in a shallow vat.

USING GELATIN

Gelatin sizing can greatly improve the strength and flexibility of a short-fibre sheet. Use a good quality gelatin (available from photographic or fine art suppliers). Mix a 2-3 percent solution by

adding $\frac{3}{4}$ -1oz (20-30g) of gelatin to a quart (litre) of hot water and stir until the gelatin has completely dissolved.

Pour the solution into a shallow plastic or enamel tray, and carefully immerse the paper. The sheets can be immersed one at a time or in a larger stack, depending on the thickness of the sheets and the depth of the tray. There must be enough size in the tray to cover the sheets completely. Use a piece of wooden dowel to lift the soaking sheets and draw them out of the tray. Lay the sheets, one on top of the other, on a felt-covered pressing board. Place a second felt and pressing board on top of the stack and press gently to force the size through the sheets. Stand the press in a tray to catch the excess size, which can be used again. Then strip the sheets carefully from the pack — remember to wash the pressing felts thoroughly and hang them to dry. Restack the sheets so that the middle ones are on the outside. Do not place the

stack under any pressure other than the weight of the paper itself. Repeat this process, changing the position of the sheets each time, until some of the moisture has left them and they become easier to handle. Then either hang the sheets up, or place them on a clean, flat surface to dry. When they are completely dry, restack them under light pressure and store them in a cool space.

If you are sizing a number of different sheets, perhaps of varying thickness, it is best to soak them one at a time. If you want to size several batches, or larger packs that need to soak for a few minutes to absorb the size, sit the sizing tray in a bath of hot water (kept at about 122°F or 50°C) to prevent the gelatin from cooling and setting during the sizing operation. It is a good idea to place a sheet of Perspex (slightly larger than your paper) on the bottom of the tray beneath the sheets to help you lift out a larger stack.



Use a piece of wooden dowel to draw the sheets out of the tray.



Lay them carefully on a felt-covered pressing board.



Separate the sheets after they have been lightly pressed.

Papermaking Variations



*Hugh O'Donnell:
Weapons of Desire,
Seaford Series III.
Coloured and pressed
paper pulp, left.
Vito Capone: Carta
sculpta. Cotton rag
paper "engraved"
with a sharp
tool, right.*



Kathryn Clark:
*Constructing Cube
in Space. Handmade
paper pulp.
Lamination with
embedments.*
24×38in
(61×97cm).



Laminating



Peter Sowiski: *Ubee,
Saturation, Stealthy
(installation).*
Coloured pulps built
up in shaped and
overlaid laminations.
60×92in (152×
233cm), (above).

Laminating is a simple technique of couching one or more newly formed sheets of paper on top of each other. During pressing and drying, the fibres of each layer bond together, creating a single sheet. Japanese handmade papers are formed by gradually laminating a thin sheet of paper on the mould surface. You can take advantage of both techniques to create subtle and interesting overlaid effects.

Laminating (also called multiple couching) can be used in a variety of

ways. For example, two layers of different colours produce a double-sided sheet, or several overlapping layers can create a soft, misty effect that is similar to that achieved using superimposed washes of watercolour. However, laminating sheets made from different fibre pulps can cause problems during drying particularly if one is a long fibre and another is much shorter, or if one fibre has a tendency to shrink more than another. To prevent distortion it is best to board dry these laminated sheets.

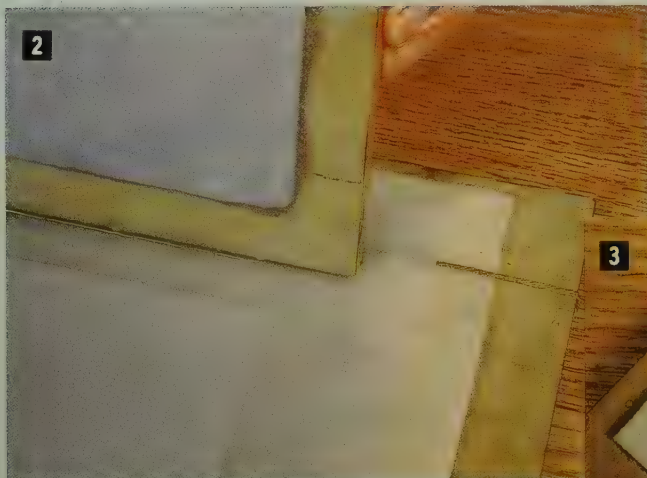


Therese Weber:
Spring Leaves.
Handmade paper
(cotton and abaca)
lamination with
embedments.
Coloured with
pigments. Pressed
and airdried.
12×8½in (30×22cm)

TECHNIQUE

Different Effects

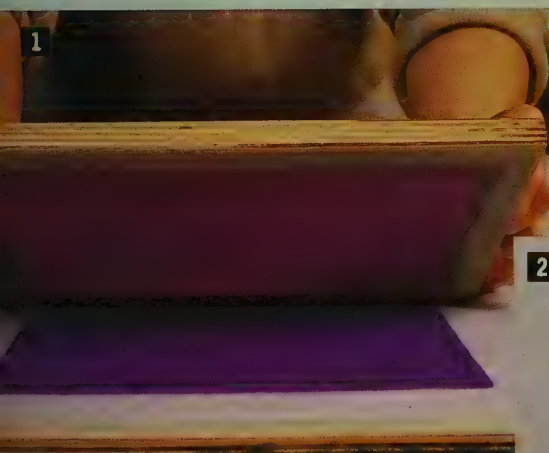
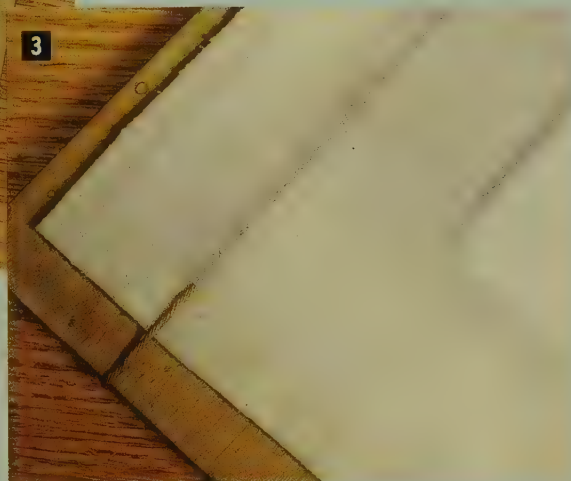
2 Make a second sheet of paper. Couch it exactly on top of the base sheet, ensuring that you line up the edge of the mould against your registration mark. When pressed, this will give a thicker sheet of the same colour.



1 Make a piece of paper. Couch it onto a dampened felt on your couching board. Devise a registration line to correspond with the nearside edge of your mould as it is positioned on the couching felt. This could be a piece of thread with the ends secured under the couching board.

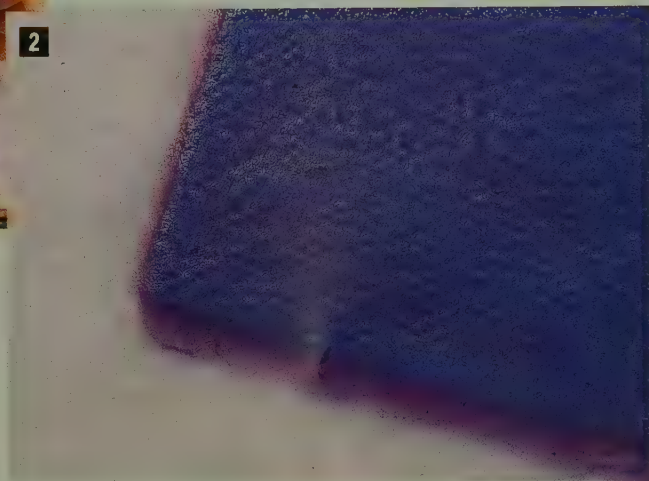


3 Without a method of registration you are unlikely to achieve an exact multiple couch.



1 To give a double-sided sheet when pressed, make a base sheet and couch it. Make a second sheet using a different-coloured pulp and couch it on top of the base sheet.

2 Couching additional layers will create a subtle intensity of colour in the laminated sheet.



YOU WILL NEED

- prepared pulp: 2-3 colours
- mould and deckle
- couching cloths
- pressing boards
- pencil or short length of thread (for registration line)

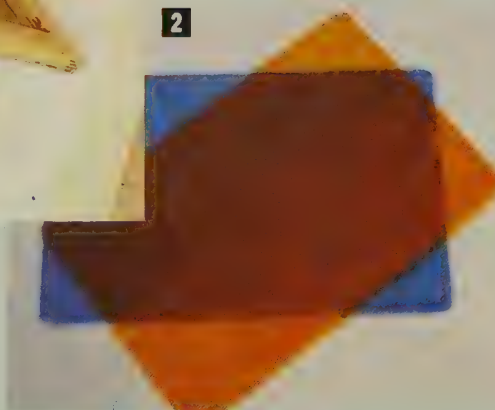
TECHNIQUES

- sheetforming
- couching
- pressing

1 Another technique involves altering the position of second or subsequent sheets, say by couching the edge of one sheet along the edge of another to extend the dimensions of the sheet.



2

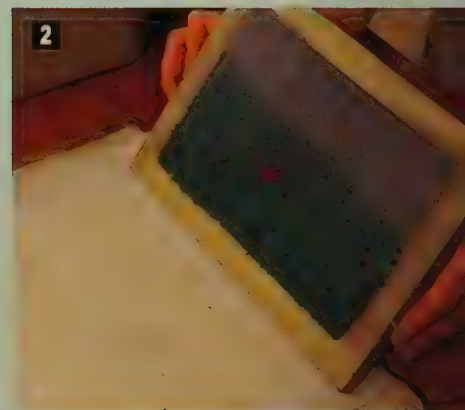


2 You can also change the angle of each sheet as it is couched onto the one below to create a non-rectangular piece of paper.



1 By removing the deckle from the mould you can build an image within your sheet by laminating washes of pulp and couching off-register. Set the deckle aside and dip your mould partially into the pulp at a 45° angle, picking up a thin wash of pulp.

2 Lift the mould straight out at the same angle. Couch the pulp onto a base sheet strong enough to support subsequent laminations.

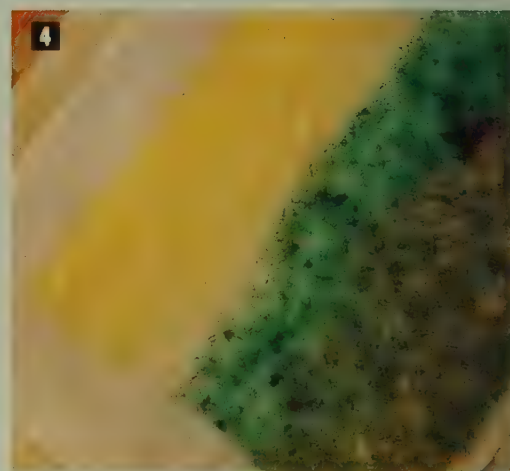


2



3

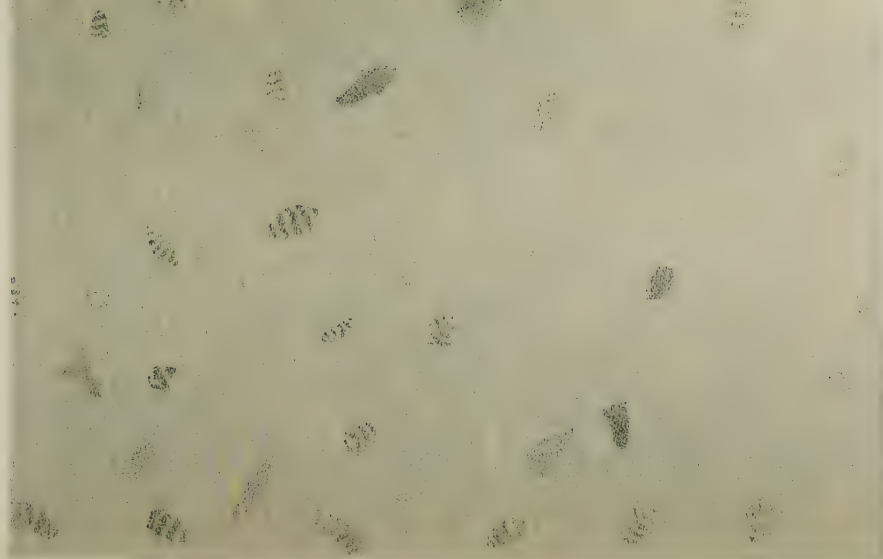
4 Continue to build up overlapping layers.



4

3 You can use both edges of the mould to pick up two washes of the same, or a different, coloured pulp.

Japanese “rakusui” paper with feathers embedded between the layers, (detail).



Embedding



*Carol Farrow:
Evier 1. Damp paper
laid over a spade and
allowed to dry.
Molded sheet
removed and painted
with acrylic wash.
47×32in.
(119×81cm).*

Embedding is a process of incorporating materials such as threads, leaves, twigs, feathers, and printed images into couched sheets of paper. Embedded elements are held in place by the fibers and the bond created during pressing and drying rather than by an adhesive.

You can embed elements in your paper while it is still wet on the mold, or, using a slightly different technique, you can couch a base sheet and place the material to be embedded on it, then couch a second sheet over the applied elements. Part of the top sheet can be torn away, partially revealing the embedded elements; they can either project from the edges of the sheet or, using an opaque pulp, they can be completely concealed between the laminated sheets.

Alternatively you could couch a translucent layer, or a very thin wash of

contrasting pulp over the inclusions, so that they are more clearly visible. You could also try dribbling a small amount of pulp over the inclusions to create a bond with the base sheet when the piece is pressed. Paper with embedded elements should be dried on a board after pressing. This will prevent the paper from wrinkling around the inclusions and distorting the sheet.

Some papers deteriorate with age and, if you are concerned about embedded papers which may be acidic, you should consider neutralizing them. There are several methods and formulations of solutions available. Also, it is advisable to check the color fastness of any embedded papers before using them. The dye from colored tissue paper, for example, runs excessively.

TECHNIQUE

Revealing an Image

1 Tear a coloured photocopied image - here a picture of a cardoon plant - into sections. (Photo-copies can be made on acid-free paper.)



2 Lay the sections onto a base sheet made from the fibres of the cardoon plant.



3 Place strips of masking tape across the mould to correspond with the position of the plant image on the base sheet.



4 Make a second sheet of paper. The pulp will only form on the untaped areas of the mould where the water can drain through the screen.



5 Couch these strips of cardoon paper on top of the plant image.



6 When pressed, the base sheet and top strips will form a bond where they meet and hold the photocopy in place.



YOU WILL NEED

- prepared pulp
- mould and deckle
- couching cloths
- pressing boards
- thin materials to place between layers
- masking tape

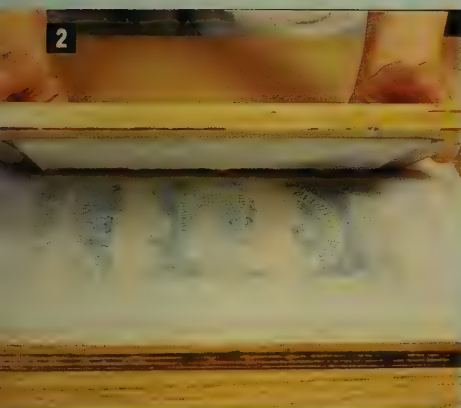
TECHNIQUES

- sheetforming
- couching
- laminating
- pressing

TECHNIQUE

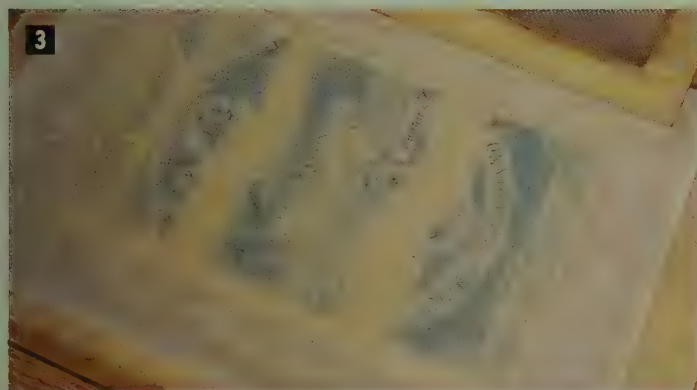
Embedding an Image

1 Position torn pieces of paper, such as this printed tissue wrapper, on a base sheet.



2 Couch a thinner top sheet over the fragments.

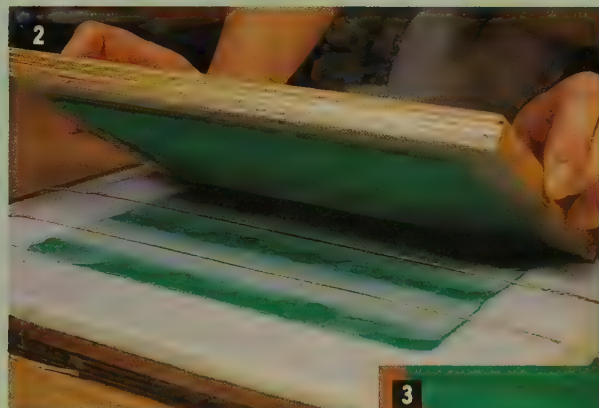
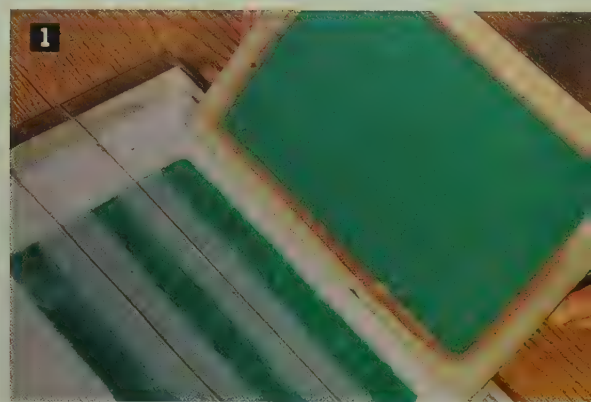
3 The embedded image becomes an integral part of the laminated sheet.



TECHNIQUE

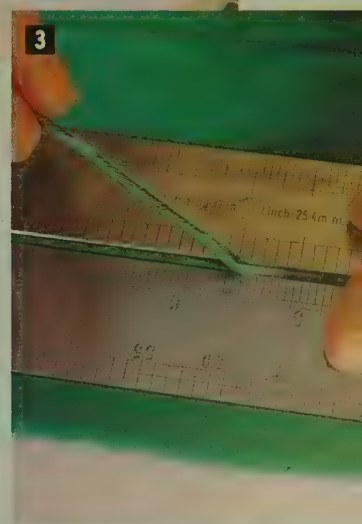
Coloured Strips

1 Couch strips of a contrasting pulp onto a base sheet and stretch lengths of thread on top of them.



2 Couch a top sheet - the same or a different colour from the base sheet - over the threads. Press.

3 Using two metal rules, tear the threads out of the damp paper to reveal the coloured stripes.



Many different types of plain and coloured papers, some with long swirling fibres and bark flecks, and others with delicate patterns and soft tones, are used for decorative and artistic purposes in Japan.

Flowers and Foliage



Cornflowers and anemones dry well in a microwave. Check after three minutes. If they do not feel and sound paper-crisp, give them a little more time. Leave to cool for a few minutes before removing from oven.

Wherever you live, you can find a wide variety of flowers and leaves, seeds from trees, ferns and grasses for making paper with plant inclusions. Sources are not only plentiful but inexpensive: suitable material can often be gathered from garden clippings and hedgerows, or among the sweepings from florists' shops and plant nurseries. Collect only as much as you need: adding just a small amount of flower material or foliage to recycled pulp, or a base stock of another plant fibre, will give your paper a distinctive character.

DRIED FLOWERS

Dried flowers can make good inclusions, especially if they have small petals that will distribute easily in the vat. Pick the flowers when they are in bloom and tie them in bunches straight away. If the flowers are at all wet, allow them to dry

out naturally before putting them in a drying cupboard.

There are two important criteria for drying flowers: heat and darkness. If you have an airing cupboard, you could hang the flowers upside down from a coat-hanger to dry there. However, the best results for some flowers come from using a microwave.

You can use professionally dried flowers but these sometimes contain glycerin and alum, which may cause your paper to discolour. You can reduce the glycerin and alum content by boiling the flowers for 10–15 minutes and then soaking them for several hours. Change the water regularly, rinsing the flowers each time. Rinse thoroughly before use.

PRESSED FLOWERS

Flowers and foliage to be pressed should be picked when the weather is dry. The ►

PROJECT

Fresh Flowers and Foliage



1 Divide larger foliage into smaller sections and place them in a saucepan of clean water. Bring to the boil and simmer for 10

minutes. Strain and rinse the leaves carefully. You can test the foliage by placing it between two pieces of clean blotting paper and pressing it

for half an hour. If the blotting paper is stained, re-soak the leaves for half an hour and rinse them through again.



2 The cypress leaf on the left has lost much of its original colour after being boiled and can now be added to the vat.



3 Soaking flowers and foliage will hydrate them so that they will be less inclined to float on the surface of the vat. Unsaturated petals and leaves can be sprinkled into the vat and will be more fully

exposed on the surface of the paper. They will be taken up onto the mould during sheet formation and embedded in the wet paper when it is couched and pressed.

YOU WILL NEED

- fresh or dried plant inclusions
- flower press
- saucepan
- blotting paper
- microwave oven (optional)
- prepared pulp
- mould and deckle
- couching cloths
- pressing boards

TECHNIQUES

- sheetforming
- couching
- pressing

4 A short- or medium-length fibre pulp will reveal the inclusions more clearly than a long-fibre pulp, which tends to tangle around the smaller plant parts. A good base pulp to use is an

equal combination of abaca and cotton linter. Use a translucent bast fibre if you want the flowers or foliage to be more visible.



◀ best time is in the early afternoon when any dew and hidden water droplets will have evaporated. Be careful to select undamaged, fresh material and press it straight away. A flower press will give the best results, although you can start by using a heavy book or pile of magazines. The most obvious effect of pressing flowers and leaves is that they become two-dimensional. This often reveals unusual aspects of the plant: subtle shapes and colours become more apparent; many colours become richer and darker, and some flowers change their colour altogether.

FRESH FLOWERS

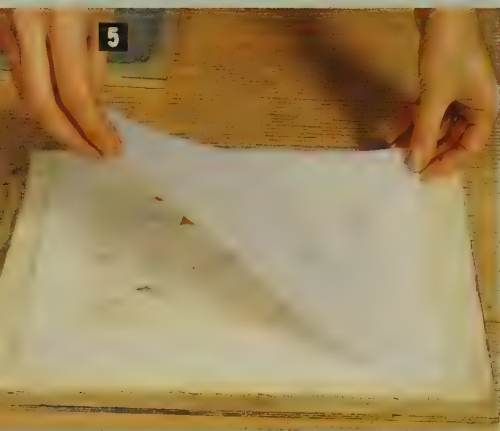
Most flowers and foliage will release their own pigments when immersed in water, some more readily than others.



Preparing flower petals at the Moulin Richard de Bas. Small petals, ferns and local grasses are added to the pulp to create a decorative

paper that is used for printing poetry, as the end papers of books and for making lampshades.

Fresh foliage should be boiled gently for 10 minutes to remove fugitive pigments and any extraneous materials that might leach into or stain the paper. Fresh flowers are generally too delicate to boil and are best pressed or dried.



5 Couch the sheets of flower paper onto pellon (vylene) interfacing, press them lightly and hang them up to air dry.

6 The combination of different leaves can create a simple yet eye-catching image. Here, the

spray foliage of a Leyland cypress is set off against a miniature autumn rose leaf.

6



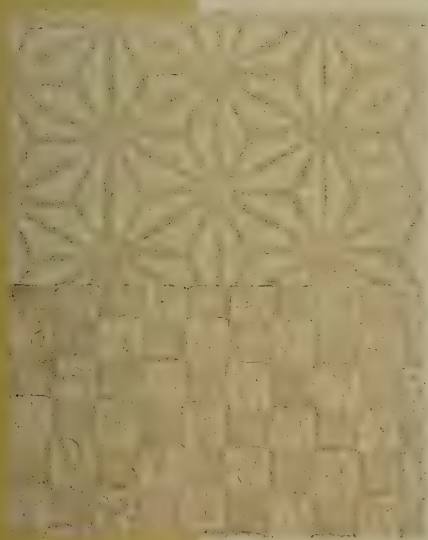
7 The buoyancy of unsaturated flowers can be used to create a dense overall surface effect. Marigold blooms have

large quantities of petals which can be picked off the flower-head and distributed in the vat.

Specialty papers (top to bottom): 100% cotton sheet, beater dyed black, mottled with white pulp; Japanese sheet with flecks of gold leaf; decorative paper with embedments; three sheets with added coloured fibres.



Decorative Effects



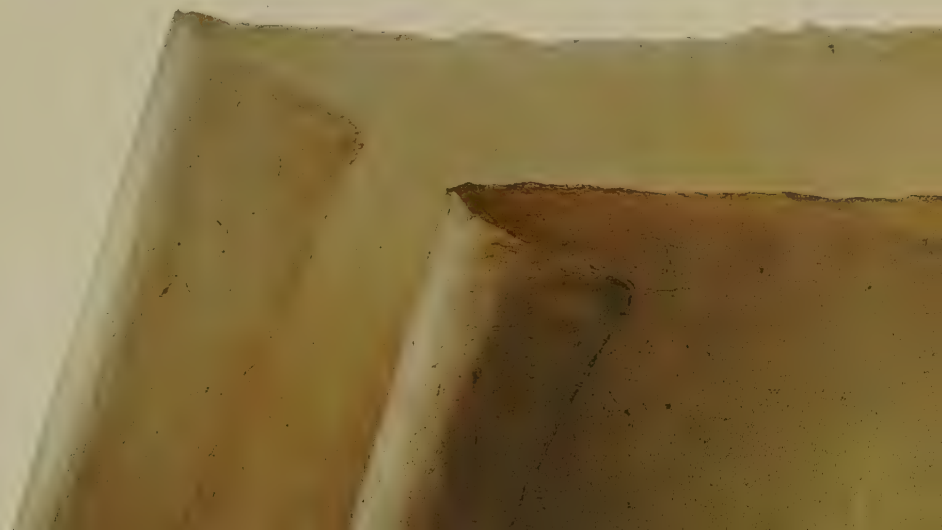
Decorative and printed pattern papers are best known for their role in book design and bookbinding. They can also serve as wallpapers or as linings for boxes, drawers and cupboards. Fancy work in paper was especially popular in Europe around 1800, when there was a craze for making small decorative objects ornamented with paper and pasteboard.

Western decorative papers include woodblock printed papers, stencilled papers, gilt papers, and marbled and

paste papers. All of these are the product of surface techniques — the pattern is applied to the surface of the paper after it has been made. Some Japanese decorative papers, such as *shibori-zome gami* (tie-dyed paper) and *orizome gami* (folded dyed paper), parallel Western surface techniques, but others are created by pulp manipulations. *Unryu-shi* ("cloud-dragon paper") is made by adding long, swirling fibres to the pulp during sheet-making.

With a little experimentation it is ►

Japanese "lace" paper (above) comes in many patterns. Nepalese and Bhutanese papers (right) are made by pouring pulp onto a floating mould.



PROJECT

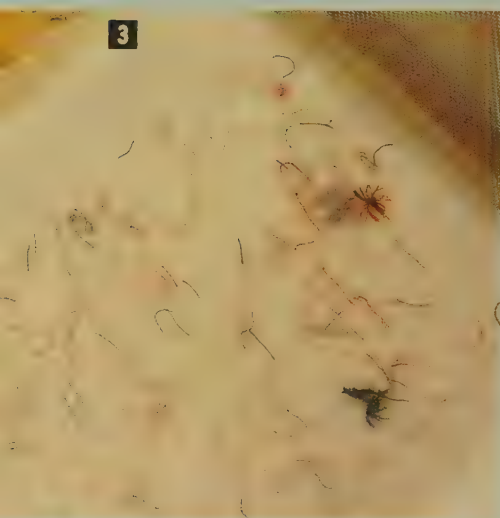
Silk Threads



1 Cut some coloured silk into small pieces. Shred some of the pieces into individual threads, by hand or in a liquidizer.



2 Add the fragments to a vat of recycled cotton rag pulp. They create a random and quite spontaneous pattern as the sheet forms.

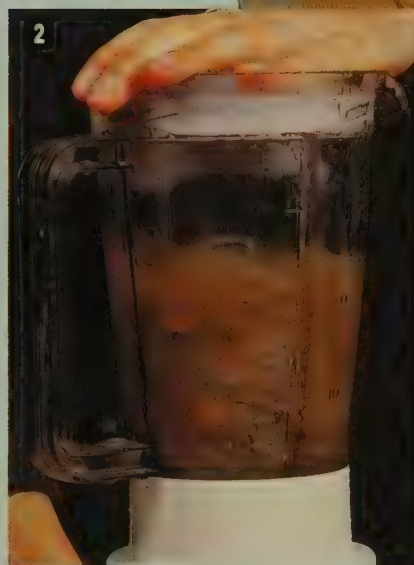
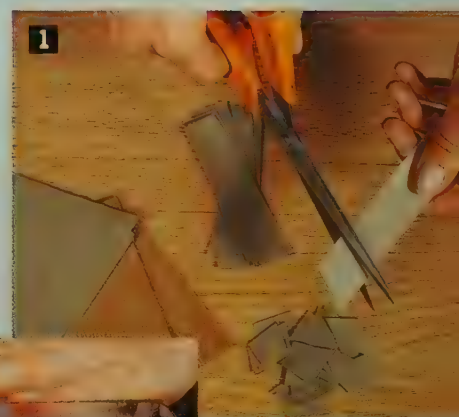


3 Some of the fragments are embedded into the sheet while others are lifted onto the surface.

PROJECT

Speckled Paper

1 Cut two or more different papers into small pieces and soak them for several hours.



2 Recycle the papers separately in a liquidizer operated in 10-second bursts, leaving some of the paper in identifiable pieces. Then use slightly longer bursts to reduce some of the paper to a finer pulp.

3 Mix the recycled pieces of paper into a plain base pulp and form your sheet. As the freshly couched sheet shows, the differently sized pieces of coloured paper create a pronounced speckled effect.



PROJECT

Lace Paper

"Lace", or "rain", paper can be made by spraying a fine jet of water at a freshly formed sheet of paper while it is still on the mould. If you cover the sheet with a stencil before you spray it, the jet of water will wash out the unprotected areas of pulp to create a pattern of holes.

2 Fill a plant spray bottle with water and spray it onto the sheet. The water will effectively displace the pulp and make holes in the sheet. You can adjust the nozzle setting to produce a diffuse spray or fine jet of water.

1 Allow a freshly formed sheet of paper to drain for a few minutes before placing it in an upright position.



3 Couch the sprayed sheet on a contrasting base sheet.



YOU WILL NEED

- prepared pulp
- mould and deckle
- couching cloths
- pressing boards
- coloured threads (Silk Thread Paper) or coloured papers for recycling (Speckled Paper) or plant spray (Lace or "rain" Paper)

TECHNIQUES

- sheetforming
- couching
- pressing

◀ possible to create a variety of special decorative effects, using a combination of simple papermaking techniques.

FLOATING MOULD EFFECTS

Nepalese hand papermaking is based on the traditional Chinese method of pouring pulp into a mould that is partially submerged in water. This technique of floating the mould, rather than dipping it, does not require a deckle. The fabric or screen is stretched underneath the frame, which itself acts as a deckle. The sheet is formed in the well of the mould and left to dry outdoors on the screen. When the sheet is completely

dry, it is peeled off and the mould can be used again. Many moulds are needed to produce a quantity of sheets in this way.

Sheets made by the floating mould method have a distinctive cloud-like fibre formation and the technique can be adapted for a wide range of special effects, using different colours. You can use an ordinary mould, simply turning it upside down, or make a mould with a slightly deeper frame especially for this technique.

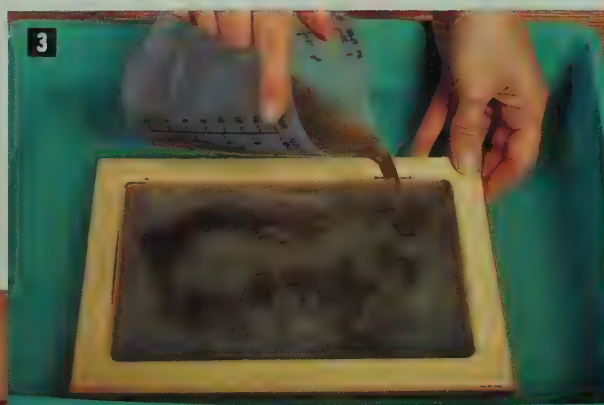
PROJECT

Floating Mould Paper



1 Half fill your vat with water. Place your mould with the screen side face down, so that the water comes through and partially fills the mould.

2 Keep the screen submerged and pour a jug of diluted pulp into it. Stir the pulp to distribute the fibres evenly.

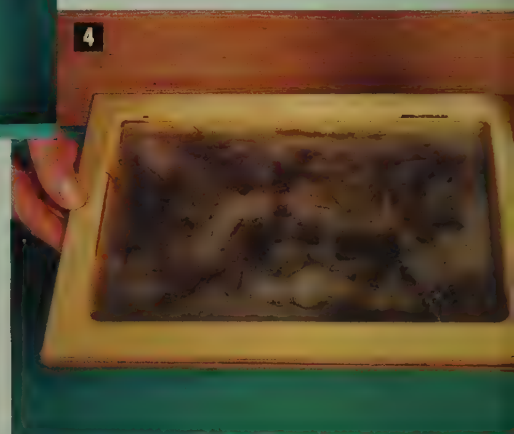


4 Holding the mould level with both hands, lift it straight up and out of the water. Rest the mould over the vat and let it drain for 5 minutes.



3 With the screen still submerged, pour in a small amount of a different-coloured pulp. Swirl the second pulp in gently with

the first and slap the coalescing pulp with the back of one hand to create an even overall layer.



5 You can place the mould on an absorbent surface and use a coupling felt to remove water.



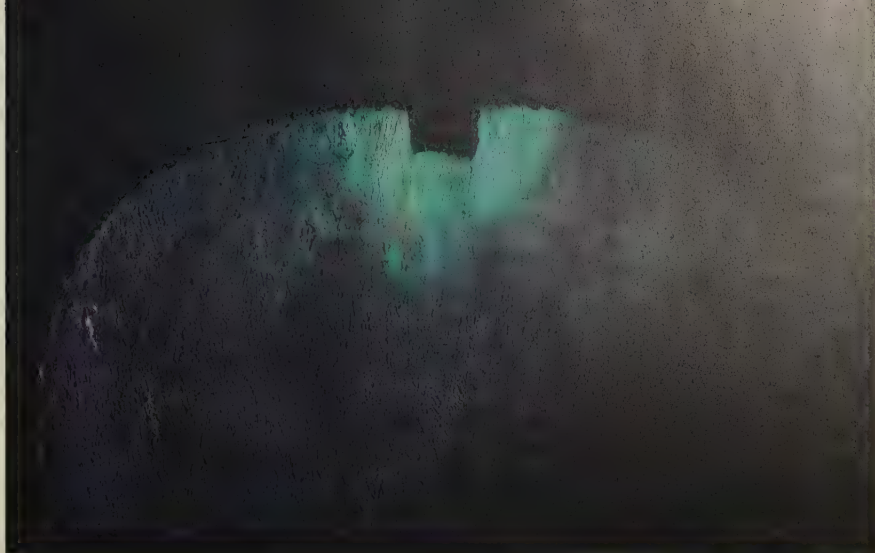
6 Stand the mould upright and leave the paper to dry.

7 When the sheet is completely dry, gently rub the back of the screen to loosen the paper. You might need to use a small spatula to part the sheet from the screen. Then carefully peel the paper from the mould.

6

7

*Soledad Vidal
Massaguer: The
Slow Way to the
Light. Handmade
paper of cotton and
Spanish flax, dyed
with natural
pigments. 28×16in
(70×40cm).*



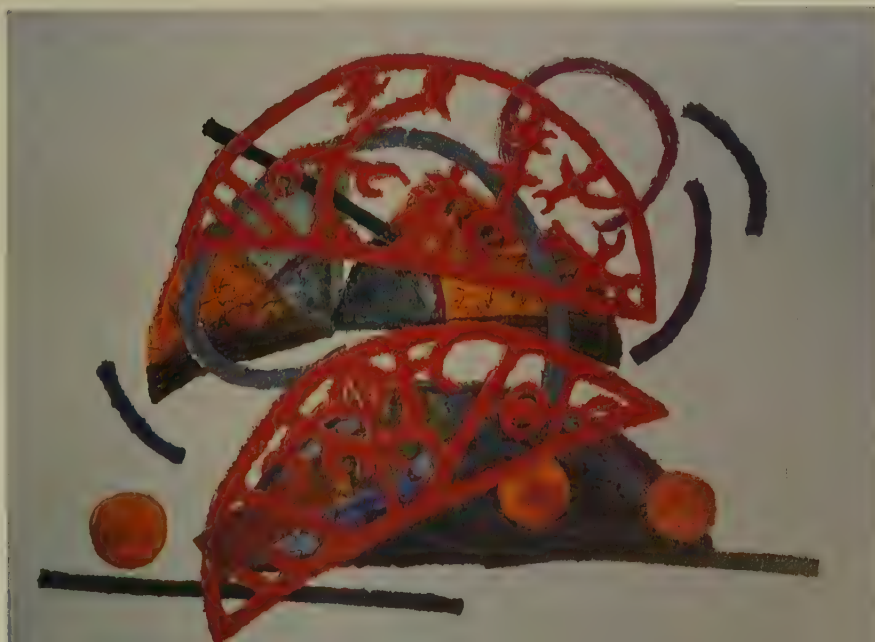
New Outlines: making shaped paper

The shape and size of a sheet of paper is determined by the deckle that fits over the mould to contain the pulp during sheetforming. There are several ways of altering the sheet's traditional rectangular format. For example, an embroidery frame with a woven mesh stretched across it will provide a simple circular mould. Alternatively, you can use a rectangular mould and make a shaped

deckle to fit over it. Simple shapes can be cut out of plywood using a jig saw and you can make more complicated deckles with a product called Buttercut (available from papermaking suppliers). An envelope-shaped deckle is useful when making stationery papers. Pastry-cutters can serve as small, shaped deckles, and a heart-shaped cake mould makes a good Valentine's deckle.

*Suminagashi
(Japanese marbling)
on handmade paper
(above).*

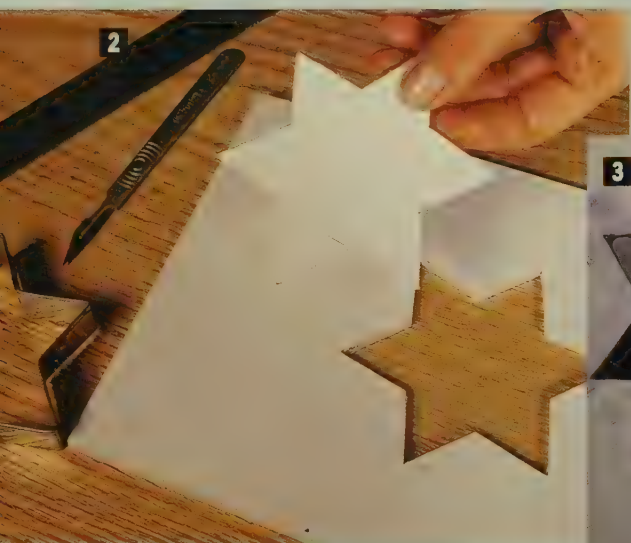
*Joan Hall: Foruja.
Mixed medium on
handmade paper.
7×9ft (2×2.7m),
(right).*



PROJECT

Fun Shapes

1 Cut a piece of foamcore board to match the outside dimensions of your mould. Draw a simple shape on it.



2 Carefully cut the shape out.



3 Waterproof the foamcore board with adhesive-backed plastic cut to the same shape. Use waterproof adhesive tape around the edges, before you immerse it in the vat. If you use wood for your deckle, coat it with water sealant.

4 Use the shaped deckle on the mould in the same way as a regular deckle. The paper will be the shape of the negative star in the deckle.



5 Laminate the star onto a base sheet.

YOU WILL NEED

- prepared pulp
- mould
- couching cloths
- pressing boards
- foamcore board ("Buttercut")
- adhesive-backed plastic/waterproof tape
- water sealant
- pencil
- cutting board
- scalpel or craft knife
- pastry cutter shapes

TECHNIQUES

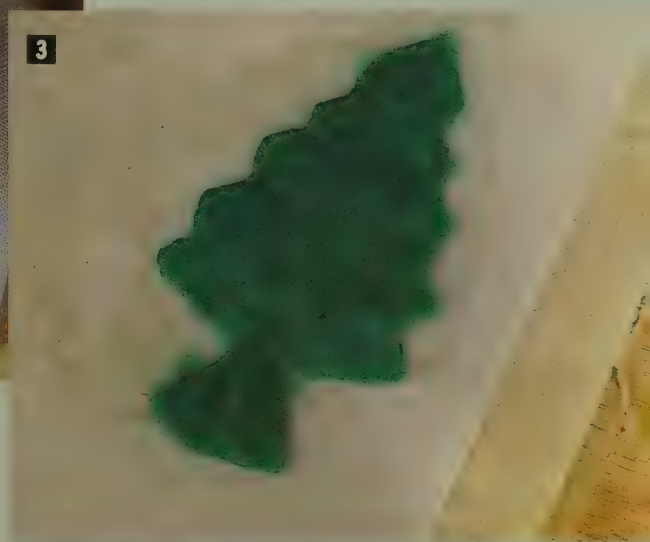
- sheetforming
- couching
- laminating
- pressing

2 When the pulp has drained, lift the cutter carefully off the mould.

1 Alternatively, turn a pastry-cutter into a deckle by placing it on a mould and slowly filling it with diluted pulp. Hold the mould over an empty container to catch the excess water.

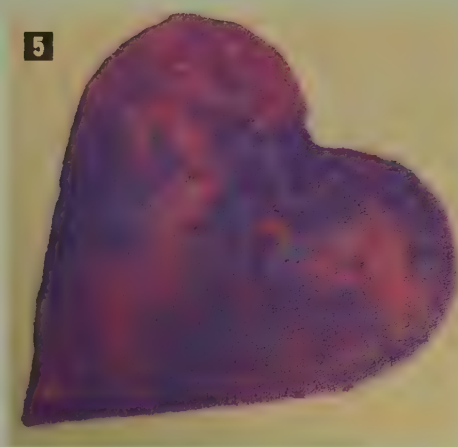


3 You can couch the shape separately.



4 A variety of shapes are possible in the colours of your choice.

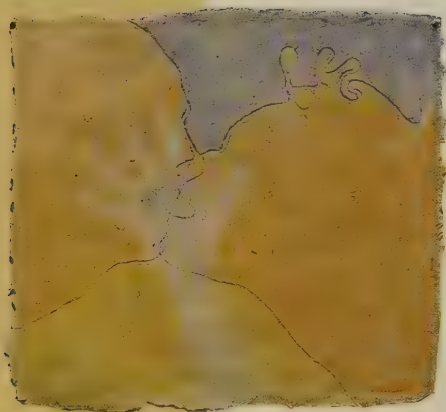
5 You can also mix different coloured pulps to create special effects.



Géza Mészáros:
*Cognitive and
 Affective
 Informations.*
 Handmade paper,
 "Rost-relief":
 modelled and painted
 while the sheet is still
 wet. 86×145×13in
 (220×370×35cm).



Embossing



Julie Norris: *The
 Last Oyster.*
 Recycled gampi
 tissue with pastel.
 17×18in
 (43×46cm), (above).

Margaret Ahrens
*Sahlstrand: Fern and
 Salmonberry (detail).*
 Embossed image on
 handmade paper.
 Plate size 30×40in
 (76×102cm), (right).

Embossing is a process which creates a raised or recessed image in a sheet of paper. The surface of the paper is altered by the pressure of a relief element applied against it. The heavier or thicker the paper, the greater the possible degree of embossment. Different levels of embossing can create a dramatic interplay of light and shadow.

You can emboss a sheet of paper either by forming it on or pressing it against a textured surface. Paper has a "memory" in this respect: it retains an impression of whatever surface it comes

into contact with, from the mould it is formed on to the felts it is pressed between and the board it is dried against. Textured fabrics, such as lace, millinery netting and embroidered cloths, leave a clear imprint when pressed against a wet, freshly couched sheet of paper. Wood blocks designed for textile printing provide a good surface for embossing. Or you might make your own lino-block or collagraph. A sheet of paper that has dried on the mould will take a better impression than a sheet which has been couched and pressed before drying.



TECHNIQUE

Embossed Shapes

YOU WILL NEED

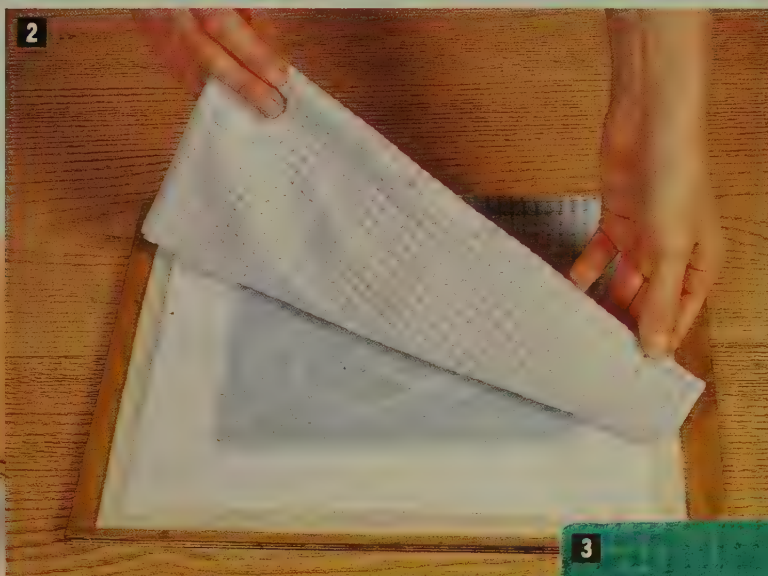
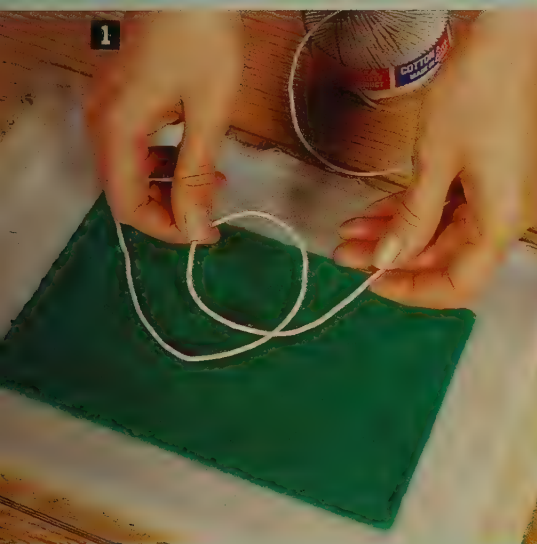
- prepared pulp
- mould and deckle
- couching cloths
- pressing boards
- scissors
- relief elements (string, textured fabric, lino-block, foamcore board)

TECHNIQUES

- sheetforming
- couching
- pressing

1 Or, unwind a length of string and cut a piece off. Place it on a freshly couched sheet of

paper. If it has been wound tightly, the string will often fall into a natural twist.



2 Cover the paper and string with a felt and then place a textured cloth on top of the felt. Press.

3 Both the string and the textured cloth have been embossed on the paper, creating different surface levels and an intriguing low-relief quality.



1 Use the cut-out (positive) from a star-shaped deckle and place it on top of a freshly couched sheet of paper. Cover the paper with an

interleaving felt. A thicker felt on top of this will provide a cushioning effect and help the paper to conform to the depth of the image.



2 When you are embossing, press each sheet of paper separately to avoid indenting other sheets. Remove the star carefully. The image has been effectively embossed into the sheet.

Gerry Copp:
Tropical Fish
Collage. Handmade
recycled paper on
wood. 19½×16in
(50×40cm).



Collage and Combining Techniques



John Gerard: *Bogen*
(Arch). Collage,
handmade paper, in
13 parts. 71×46in
(180×116cm), (above).

Richard Flavin:
Collage G-10.
Collaged handmade
paper with wood-
block monoprint.
12×23½in
(30×60cm), (right).



Collage gets its name from the French verb *coller*, to paste. The art of collage consists of pasting together various materials, but particularly paper, to create a composite image. The histories of collage and papermaking are closely linked. The earliest known collages were made in the 12th century by Japanese calligraphers, who copied poems onto various pieces of tinted paper pasted together into sheets. Cut-out paper

shapes of birds, stars and flowers were used to ornament the text.

Many contemporary collages are made from gathered scraps of used paper. They juxtapose disparate images and textures, torn and cut edges, hand dyed and painted papers. Newspapers, magazine pictures, advertising posters, wrapping papers, computer cards, coloured and printed papers of all kinds are retrieved and given a new aesthetic ►

PROJECT

Collage Shapes

YOU WILL NEED

- prepared pulp: 2 or more colours
- mould and shaped deckles
- couching cloths
- pressing boards
- wide, soft brush

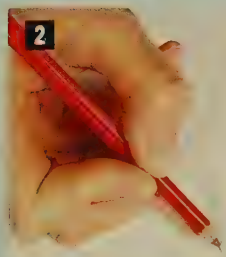
TECHNIQUES

- sheetforming
- couching
- laminating
- shaped paper
- pressing

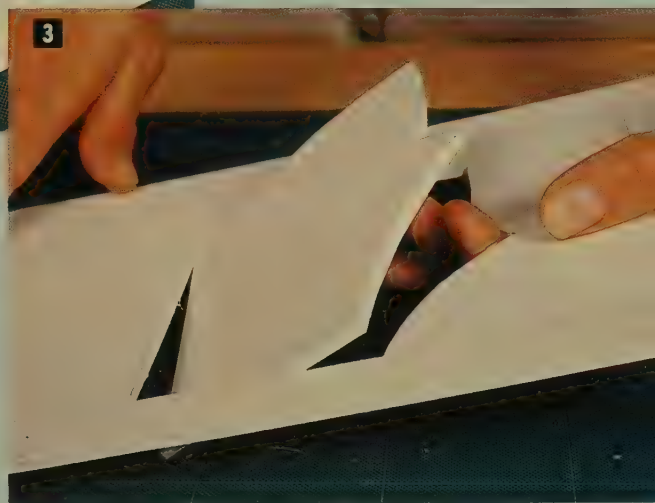
1 Cut a piece of foamcore board to match the outside dimensions of your mould.



2 Draw a series of shapes on it.



3 Carefully cut the shapes out. Waterproof the foamcore board before you immerse it in the vat (see p. 70).

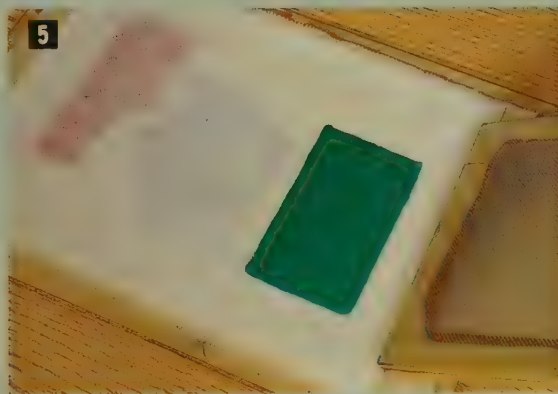


4 Make a base sheet, couch it and set it aside while you are using the shaped deckles. Place the

deckles on the mould and make each shape with a different coloured pulp.



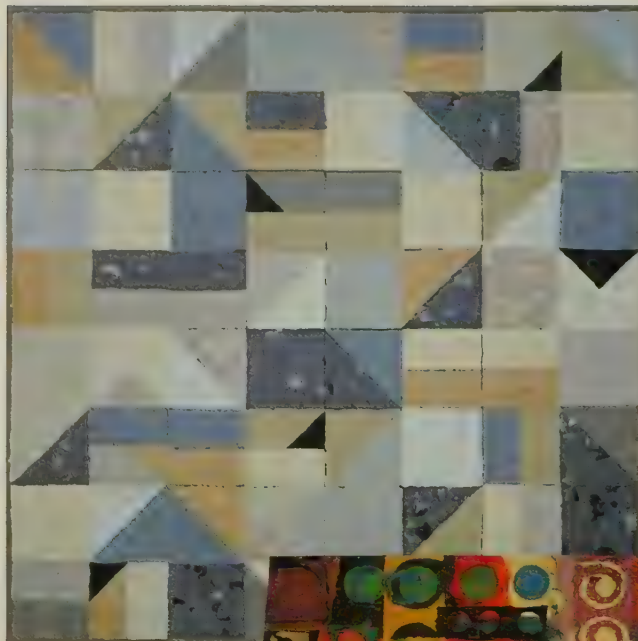
5 Couch the shapes separately, each interleaved with a felt in the order in which they will be laid. Put between boards under a light weight or in a press. Use just enough pressure to remove the excess water.



◀ meaning. The tradition of collaging waste papers has recently been extended to include handmade paper, thus bringing together the permanence of craftsmanship with the disposability of mass production.

A COLLAGE COLLECTION

Start by building up a collection of found papers, paying attention to their surface texture and tonal qualities as well as any printed text or imagery. Printed tissue fruit wrappers, weathered poster papers, metallic foil paper, coated papers, tickets and torn postage stamps, for example, can form a useful basis for recycling and collage. Although recycled paper generally lacks the subtlety of a handmade sheet, it can possess a beauty of its own in terms of colour, feel and texture.



John Gerard:
Collage. Handmade
paper in 16 parts.
35½×35½in
(90×90cm), (left).

Gerry Copp: Offcuts.
Handmade recycled
paper on wood
27½×12in
(70×30cm), (right).



Richard Flavin:
Collage B-4.
Collaged handmade
paper. 17½×17½in
(45×45cm), (right).



6 Lift the first
shape from its felt.



7 Place it in
position over the base
sheet. Use a damp
sponge to lift the
shape if it appears
fragile.



8 A wide soft
brush can be used to
smooth the shape
down and tap out any
air bubbles that may
be present.



COMBINED COMPOSITIONS

There are various ways to incorporate throwaway scraps of paper or other ephemeral collage material into your handmade production process; or you might prefer to work exclusively with your own handmade papers. You can combine the techniques of laminating, embedding, embossing, and creating shaped papers, shown earlier in this section, to make a collage composition. For example, textured pieces of paper can be laminated onto freshly couched sheets of contrasting colour and combined with embossing. Or an embedded image might be revealed by couching a decorative top sheet that has a sprayed pattern of open spaces.

9 Continue to laminate each shape onto the base sheet until all the pieces are in place.



10 Return the finished sheet to the press and use a heavier weight or increased pressure to secure the bond.



Otávio Roth:
Untitled. 50,000
 paper elements made
 from chewed cotton
 rag.



Paper's Precursors



*Tapa cloth is mostly
 undecorated, but can
 also be stamped,
 painted or stencilled
 with geometric
 patterns and animal
 and plant motifs.*

A number of ancient materials resemble paper but are not, strictly speaking, paper at all. Some served as a writing surface and some had additional functional and spiritual uses. Papyrus, *tapa* and *amate* (from tree bark), and rice paper can all be called precursors of paper with regard to their uses, and all are derived from vegetal material. Their manufacture, however, differs from that of true paper: they are not made from macerated fibres that have been dispersed in water and collected on a mould.

PAPYRUS: THE ANCESTOR OF PAPER

Papyrus is made from the stems of the papyrus plant (*Cyperus papyrus*), which used to grow prolifically in the marshy areas along the banks of the Nile. The oldest surviving specimen of papyrus dates back almost 5,000 years to 3,000

BC. The papyrus plant was used for an astonishing number of purposes including fuel, boats, ropes, mats, sandals, blankets and clothes. Its chief function, however, became that of a writing material. Papyrus sheets were cut to standard sizes and polished with pumice. They were used either singly or glued together to form a longer roll. (The Great Harris Papyrus manuscript, preserved in the British Museum, is 133 feet/40.5 metres long.)

POLYNESIAN PAPER

Tapa is the Polynesian word for a cloth-like material made from the inner bark of a variety of trees, especially those in the mulberry family. It is produced by soaking the bark and pounding it into sheets. Various forms of tapa were used throughout the Pacific, South and Central America, Africa and Southeast Asia ►

PROJECT

Making a Papyrus sheet

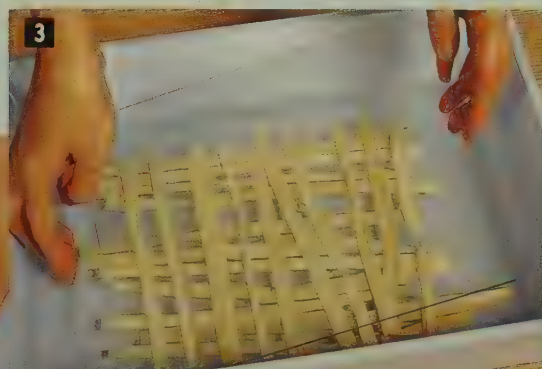
Successful papyrus-like sheets have been made using substitute fibres from the bulrush stem, cornstalk, and even the amaryllis plant. Find out whether there are any such

plants growing in your area that you could harvest to make your own papyrus paper. Alternatively, dried strips of papyrus and papyrus-making kits are available from the

Papyrus Institute in Cairo or from hand papermaking suppliers. The kit contains two sets of dried pre-cut strips, 5in (12.5cm) and 6in (15cm) long.



2 The 5in (12.5cm) strips should be laid on top. Soak at room temperature for 2-3 days.



1 Place a layer of 6in (15cm) dried strips in a tray of water.

3 The strips tend to float, so it is best to devise a weight,

such as a sheet of glass, to keep them submerged.

4 Take the strips out of the water and roll them on a smooth board with a rolling pin. Re-immersing the strips in a tray of fresh water for a further two days. Having absorbed some water, the strips are less likely to float and you may be able to dispense with the weight.



YOU WILL NEED

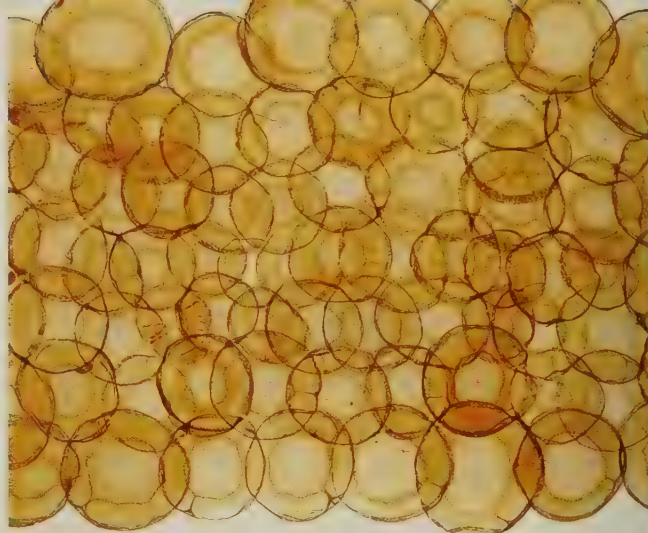
- collected plants (as recommended)
- sharp knife (for harvesting stems and slicing into strips)
- vegetable peeler (for removing skin off stems)
- or papyrus kit
- shallow tray
- wooden board
- rolling pin
- 2 cotton towels
- 2 cotton handkerchiefs

◀ for many purposes. In ancient Hawaii, tapa was used for ceremonial clothing and burial wrappings, bandages, bedding, string and lampwicks.

AZTEC PAPER

Amate is also a pounded bark paper. It was originally made by the Aztecs from the inner bark of wild fig trees, although the Maya had earlier developed a beaten bark material called *huun*. The Aztec word *amatl* means both paper and fig tree. Amate is made by cooking the strips

Translucent carrot paper made from sliced vegetable cross-sections laminated in a process similar to the manufacture of papyrus.



of inner bark with a wood ash lye. The strands are rinsed and laid out in a grid formation on a wooden board. The

fibres spread as they are beaten and fill the gaps. The amate sheets are left to dry on the boards in the sun.



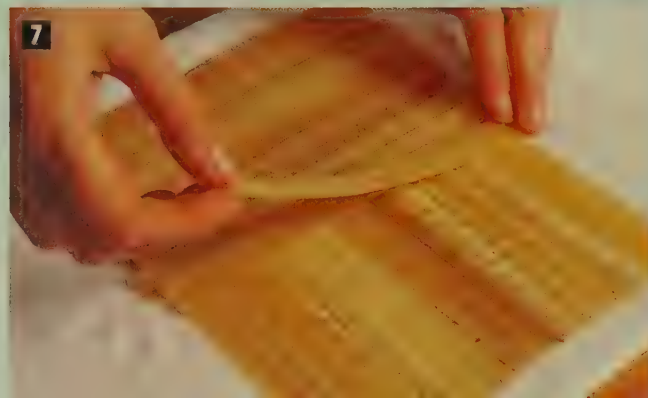
6 Lay a small towel on a flat surface and cover it with a piece of cotton, such as a clean handkerchief. Take one of the wet

strips and lay it in a vertical position along an edge of the cloth. Place another strip of the same length parallel to the first with a slight overlap

of about $\frac{1}{16}$ in (1-2mm). Continue to lay out the remaining strips of the same length in this way.

5 After the second two days, repeat the rolling process, using a little less pressure. Return the strips to the water (without changing it) for a

further three days. When the strips become translucent and sink to the bottom of the tray, they are ready for sheetmaking.



7 Lay the other strips in a horizontal direction on top of the first layer, overlapping each strip as before.

Like *huun* before it, *amatl* was widely used as a writing surface for sacred calendars, prophecies and divinations, historical records and medical treatises. It was also central to the religious practices of the Aztecs. *Amatl* is still made by the Otomi Indians of southern Mexico, who have preserved its powerful symbolic role in their ceremonies.

RICE PAPER

Rice paper is the erroneous name for a paper-like material made by cutting the

spongy inner pith of the rice paper plant (*Tetrapanax papyriferus*) into fine veneer-like sheets.

UNUSUAL PAPERS

Experiments in the 18th century to find new materials for papermaking led to the production of assorted “strange” papers. Naturalists tried working with an extraordinary number of alternative plant and vegetable fibres, including seaweed, pine cones, moss, nettles, potatoes, grass, grape vines and straw.

UNUSUAL PAPERMAKERS

The way that wasps make their nests from chewed-up wood pulp, and the paper-like product of their labours, were noted by the French naturalist and physicist René-Antoine de Réaumur in 1719. In modern times the wasps have found an imitator in Brazilian artist Otavio Roth. His techniques include actually chewing a piece of his cotton T-shirt for two hours to produce a mouthful of pulp.

8 Cover the strips with a clean cotton cloth.



9 Cover the cotton cloth with a towel.

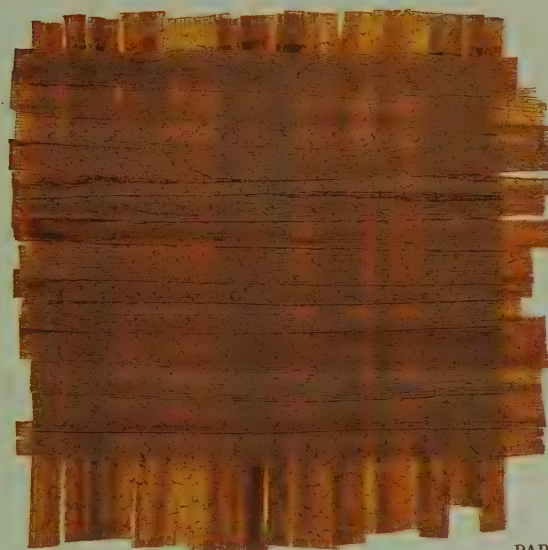


10 Carefully roll the “sandwich” of papyrus strips to press out the excess water. Remove the wet towels but leave the pieces of cotton cloth on either side of the papyrus sheet and place it between a thick layer of folded

newspaper. Put a board and weight on top of the newspaper or place it between wooden boards in a small press, if you have one. Change the wet newspaper after 2 hours, then after 6 hours, and again after 24 hours.

Leave the papyrus sheet in the press until it is completely dry, continuing to change the newspapers every 24 hours. Finally, remove the papyrus from the pieces of cotton cloth and weight the sheet between clean, dry paper for a further 48 hours.

10



Watermarks are formed in the paper as it is made, which makes them difficult to counterfeit. As a result, they are an important feature of banknotes and other security papers.



Watermarks: a hidden image



A subtly shaded chiaroscuro watermark portrait of Nicholas Louis Robert, inventor of the first paper-making machine.

A watermark is a translucent area in a sheet of paper, usually in the form of an outlined image or initial, which is barely visible except when held to the light. It is the result of an impression left in the pulp during formation of the sheet by a fine wire shaped into the desired design and attached to the surface of the mould. The pulp settles in a thinner layer over the slightly raised area of the watermark device. The earliest examples of watermarks come from late 13th-century Italy, and the oldest known watermark is a rough cross with a small circle at the end of each branch and a larger one in the middle.

The term watermark is a misleading one since it is the wire design that creates the translucent areas in the sheet and water plays no particular part in the production of the image. The French word *filigrane* and earlier English terms “wire-

mark” and “papermark” are more accurate descriptions of the hidden images which are a distinctive feature of European paper.

MAGICAL IMAGES

A tremendous variety of pictorial designs, including images of animals and birds, humans, flowers and trees, heraldic themes, and simple shapes such as circles, crosses and stars, can be found among early watermarked papers. The exact purpose of these images is unknown, but they probably helped identify the moulds of illiterate papermakers. Some theories suggest that they may have had a religious or magical significance. Today, watermarks mainly serve as the logo or trademark of a particular paper, mill, papermaker, or artist.

PROJECT

Creating a Watermark

1



1 Draw a simple outline on a piece of paper. Then bend a wire thread with a small pair of pliers to the shape of your design. Components of a more elaborate wire design need to be soldered. If you use fishing line, sew it directly onto the mould cover.

2 Sew the wire shape onto the surface of the mould with a strong, fine thread. You need only attach it at key points to keep it firmly in place. Remember that the design will appear as a mirror image on the sheet of paper.

2



3

3 Use a short to medium length fibre for your pulp to achieve a clear image. As you raise the mould from the vat less pulp will settle over the slightly raised mark than over the rest of the screen, and the watermark

will form as part of the sheet. When the sheet is pressed and dry, hold it up to the light. The more translucent areas of the sheet, where the watermark image was attached to the mould, will become visible.

YOU WILL NEED

- pencil
- paper
- soft brass wire (.030-.040 gauge) or other rustproof wire, available from jewellery suppliers
- fishing line (alternative to wire)
- small pliers
- needle and thread
- hand soldering iron (optional)
- mould and deckle
- prepared (short fibre) pulp
- couching cloths
- pressing boards

TECHNIQUES

- sheetforming
- couching
- pressing

PROJECT

Experimental Watermarks

There are other ways to create a watermark effect. Small adhesive labels can be applied to the surface of the mould when it is dry. A water-resistant adhesive, or even nail varnish, can be used to "draw" a design on the mould - but you

will not be able to remove it from the screen afterwards. Water cannot drain through the masked areas during sheetforming and so the pulp does not settle on them.

YOU WILL NEED

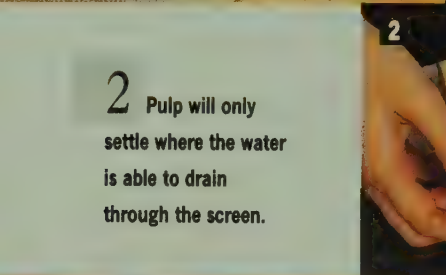
- adhesive labels or water-resistant adhesive
- prepared (short fibre) pulp
- mould and deckle
- couching cloths
- pressing boards

TECHNIQUES

- sheetforming
- couching
- laminating
- pressing



1 Attach adhesive labels to the surface of the mould.

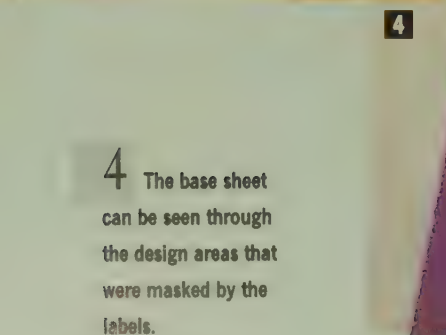


2 Pulp will only settle where the water is able to drain through the screen.

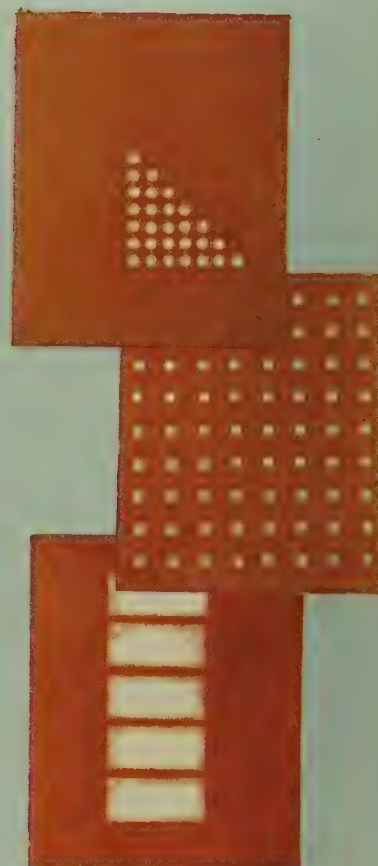


3 Laminating a sheet with this watermark design onto a freshly

couched sheet of a different colour creates a see-through effect.



4 The base sheet can be seen through the design areas that were masked by the labels.



These designs were formed by attaching adhesive labels to the surface of the mould before sheetforming.

Golda Lewis:
Citigeometric. Paper
made directly on
unsized canvas with
assembled
materials. 30×36in
(76×91cm).



Pulp Painting



Géza Mészáros: *The
Big Iconoclastic Icon*.
Handmade paper,
with gold paint.
61×46in
(155×115cm) (above).

Kathy Crump: *Fan
Shape* (detail). Pulp
painting, folded,
hibiscus over kozo
paper. 18×25in
(46×63cm), (right).



Pulp painting uses paper pulp as if it were paint. The pulp is usually applied to a supporting surface, which may itself be paper, using various freehand techniques. It can be sprayed, spattered, squeezed, daubed, dripped and poured.

Many artists have been fascinated by the inherent qualities of paper: its malleability, its colour and texture. They have learned to make paper and to make paper work for them as a tool in developing their art. Their work often reveals

more about the nature of paper itself than about paper as a supporting surface for other media. Approaches to working with pulp result to some extent from the particular interests of the artist and frequently combine drawing, painting and printmaking with one or more aspects of the papermaking process.

The sequences involved in traditional methods of Eastern and Western sheet-forming (see p. 38-9) and watermarking (see p. 82) offer a strategy for creating ►

TECHNIQUE

Pulp Painting

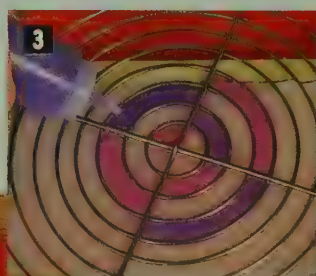
1 Make a sheet of paper and rest the mould over a shallow tray to drain. Place a wire frame, such as a cake cooling rack, on top of the sheet. Prepare the coloured pulps with formation aid and put them in plastic squeeze bottles. Test to see that the pulp flows evenly through the nozzle.



2 Apply the first coloured pulp, directing the flow of pulp into a section of the cooling rack. Squeeze the bottle slowly with a steady pressure and paint in a thin layer of pulp. Wait for the water to drain before applying any more pulp or it will spill over into the adjacent section.



3 Gradually fill in the sections using one coloured pulp at a time.



4 When the water has drained, carefully remove the frame, and then couch and press the sheet.

◀ pictures. The Japanese method of multiple dippings, for example, can be used to re-immense the mould into vats of differently coloured pulps.

PULP PAINTING TOOLS

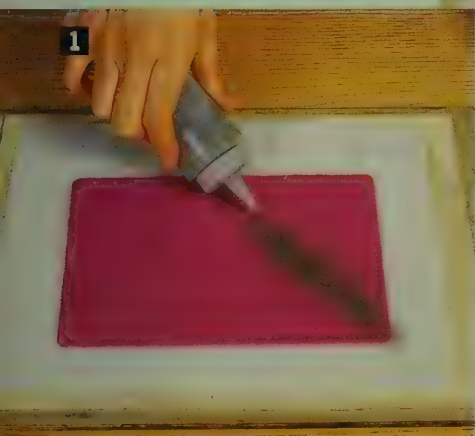
Plastic squeeze bottles can be used to hold the pulp for painting. Almost any well diluted pulp can be used, although better results are achieved with a longer, over-beaten fibre (see p. 102), combined with a formation aid. Abaca and flax are recommended, especially where translucency or intense colour is desired. The addition of formation aid helps prevent the fibres from clumping together and blocking the nozzle of the bottle. The proportions of water, fibre and formation aid can be adjusted until you have a pulp that flows easily. It is better to start with a little formation aid and add more as necessary.

A template or stencil can be used as a guide when pouring the coloured pulp. Flexible plastic strips can be positioned as barriers, and brass or copper “fences” can be shaped to contain the poured pulp. When the barriers are removed, a slight shake before the water drains will soften and merge adjoining borders of pulp. Alternatively, you can apply the pulp freehand using spontaneous, painterly strokes.

TECHNIQUE

Painting Freehand

1 Apply the first coloured pulp in a thin, steady stream, working spontaneously or following your design.



2 When the water has drained, proceed with the second colour.



3 Continue applying each colour in turn, ensuring that the water always drains away between applications.

YOU WILL NEED

- wire frame, i.e. cake cooling rack
- plastic squeeze bottle or turkey baster
- prepared pulp
- formation aid
- mould
- catch tray or couching felt on board

The colour of an underlayer can show through the pulp poured over it to interesting effect. Moreover, characteristics of surface, density and translucency will vary with different types of fibre and methods of pulp preparation.



TECHNIQUES

- sheetforming
- couching
- pressing

You can also couch a base sheet onto a dampened felt and paint pulps into it. If you have a working drawing, the base sheet can be marked

lightly with a plastic knife in accordance with your design. If you are layering coloured pulps, make a note of the order in which to apply them.

Place a thicker felt underneath everything to absorb the water from the pulps.

*Elaine Koretsky
demonstrating pulp
spraying techniques
at an International
Paper Conference.*



Pulp Spraying



*Donna Koretsky:
Tree Rings:
expanded version
(detail). Sprayed flax
fibre. 78½×23½in
(200×60cm).*

Pulp spraying is a popular technique which can be used to create large sheets of paper without a large vat system. The device for pulp spraying is based on a standard industrial tool for spraying paint, plaster or concrete, and is powered by an air compressor. The effect is similar to that of an airbrush and subtle colour changes can be produced by gradually building up and overlapping successive layers of pulp. Pulp spraying can be successfully used on both two- and three-dimensional surfaces.

Pulp spraying equipment consists of a spray pistol, a hopper (container), and an air compressor of at least one, and preferably two, hp. The size of the compressor determines the volume you can spray. The beaten pulp is poured into the hopper, which is linked to the spray pistol by a length of hose. Another hose connects the pistol to the air compressor.

When the air compressor has built up pressure in the tank, the trigger on the pistol is squeezed to release the pressure and spray the pulp. The pistol comes with interchangeable nozzles which offer a variety of wide and narrow spray patterns. You can obtain a complete system with full directions for use from a hand papermaking supplier.

CHOICE OF PULP AND SURFACE

You can spray almost any pulp, with the addition of formation aid (see p. 27), onto a variety of porous surfaces. Abaca is a good pulp to start with if you want to form strong, thin, translucent sheets. Cotton pulp can be used to build up an opaque surface. Longer fibres can be prepared to produce a pulp which will give a strong, high-shrinkage paper for sculptural work. You can use three-dimensional moulds or armatures to ►

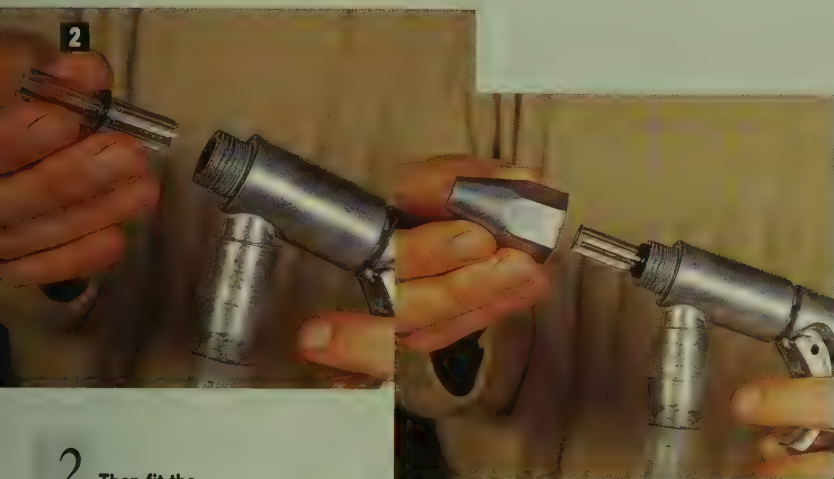
TECHNIQUE

Two-dimensional Spraying

1 Connect the spray gun to the air compressor. Drain the prepared pulp for a few seconds and add $\frac{1}{2}$ –1 cupful of formation aid to each gallon (4.5 litres) of drained pulp, stirring it in well. The pulp mixture should feel quite slimy. Have a

bucket of fresh water standing nearby to dilute the pulp as required. Sizing and other additives (see p. 27) may also be mixed in and sprayed with the pulp. A dilute mixture of methylcellulose in the pulp will give extra rigidity to the finished

piece. A small amount of acrylic gel will also act as an adhesive and will lend a reflective quality to the surface of the work. Wet the support fabric by spraying it with water. This will help the layers of diluted pulp to adhere to it more securely.



2 Then fit the pistol with a nozzle liner and connect it to the hopper with the hose provided.

3 Fill the hopper with the pulp and place it on a level surface near the piece you are going to spray. Start the air

compressor, and when the correct working pressure has built up, pull back the trigger on the pistol to spray the pulp.

YOU WILL NEED

- pulp sprayer (available from leading hand papermaking suppliers)
- air compressor (1½–2hp)
- prepared pulp(s)
- formation aid

- woven fabric: unprimed cotton or linen canvas, silk screen fabric, muslin, etc.



◀ create sculptural forms, and most woven material, provided it is not too loosely structured, is suitable for two-dimensional work. When dry, the mould or supporting surface can, if you wish, be removed from the sprayed paper form.

You will need to vary the pulp mixture to suit your surface and the nature of your project. A smooth surface, such as a silk-screen, will require a more dilute mixture than a coarser woven cloth. Because of the amount of water involved, spraying the pulp horizontally will minimize the risk of its sliding off a

smooth surface. A wet-dry vacuum cleaner with a squeegee (rubber blade or roller) attachment can be used to speed the removal of excess water from the back of such a surface and will help to draw the pulp more securely onto it. Other flat or relief pieces can be sprayed from any direction. Spray the pulp in a succession of thin layers, letting it drain thoroughly between each application, to ensure that it does not slide off. About 4–6 layers will produce a strong enough sheet, which will peel away from the support fabric when completely dry.

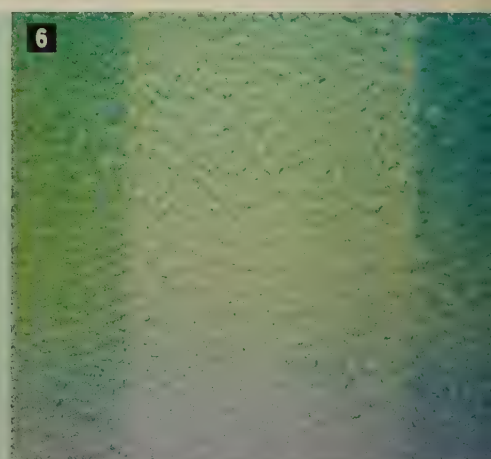
Stretch your chosen material taut, preferably across a frame as if you were making a standard mould cover (see p. 22). This applies to both flat and three-dimensional structures, because pulp will run and pool into any sagging areas. Suitable materials include unprimed cotton or linen duck, muslin, interfacing, silk-screen fabric, a close-weave wire mesh, or even polyethylene sheets. Spraying pulp onto a non-porous material, such as a plastic drop cloth, will give a smooth and glossy surface to the sheet which dries against the plastic.



4 Spray the pulp in thin, even layers, waiting for the water to drain after each layer. Use the smallest nozzle liner to spray a narrow pattern. You can reduce the air pressure to spray as close as 2in (5cm) from the work but be careful not to spray too close or you may

blow a hole in the piece. If the pistol becomes clogged, place a finger on the nozzle and gently pull the trigger until the pulp blows back down the hose. You may then need to adjust the ratio of formation aid and water in the pulp.

5 You can apply different coloured pulps in solid bands or in diffused overlapping layers. Careful colour blending can be used to achieve a subtle intensity of colour which appears to radiate from within the piece. There is considerable potential too for combining techniques with the pulp sprayer, adding details by laminating, embedding, or applying pulp freehand with the aid of a plastic squeeze bottle. You can use a variety of stencils to mask out areas of the work while you are spraying.



6 One of the characteristics of pulp spraying is this slightly textured pattern of water drops. After you have finished using the pulp sprayer, rinse the system through with clear water. Take out the nozzle liner and remove any bits of trapped pulp.

A vacuum table is a useful piece of studio equipment and is relatively simple to construct using a wet-dry vacuum cleaner.



Vacuum Forming

Vacuum-forming techniques offer an exciting alternative to traditional sheetforming methods and facilitate a wide range of paper pulp applications. A number of vacuum systems have been designed since the first vacuum tables appeared in the late 1970s, but all of them work on the same basic principle: atmospheric pressure is used to compress a newly formed layer of pulp, thereby extracting the water from it.

THE VACUUM TABLE

The system consists of a table, through which water is drawn from the pulp, a holding tank for the water, and a vacuum pump. The traditional table is made of marine plywood with small holes drilled at 6-10in (15-25cm) intervals. Beneath the table-top the holes lead into a vacuum chamber which is connected to the holding tank by a

plastic hose. Another hose links the holding tank to the vacuum pump. The construction must be airtight to operate efficiently, and all surfaces, inside the vacuum cavity and on the table, are sealed with several coats of polyurethane varnish. An optional raised edge can be attached to the four sides of the table to contain the wet pulp if large amounts are used.

To create the vacuum, a plastic sheet is laid over the wet pulp and a seal is formed between the plastic and the table surface. When the vacuum pump starts, the air is drawn out from under the plastic and within the vacuum chamber. As the air is removed, the wet pulp is compacted by the pressure of the atmosphere on the outside of the plastic, and water is extracted from the pulp.

Vacuum systems are frequently used for sheet sizes that exceed the limits of ►



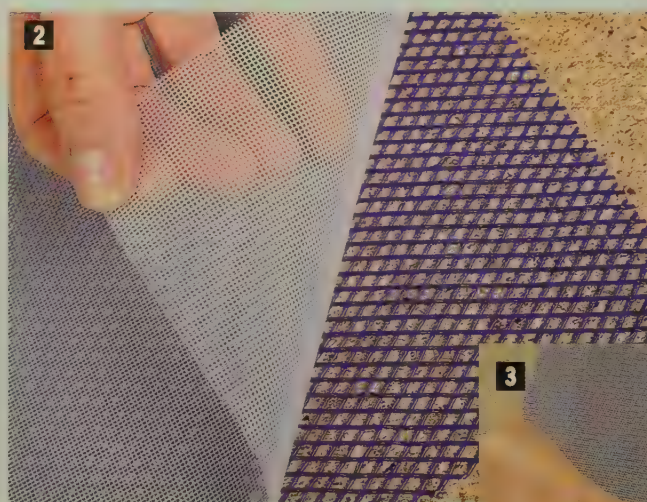
It can be used when fragile or dimensional embedded elements prohibit traditional pressing; for casting; or for de-watering large sheets which cannot be accommodated in a press.

PROJECT

Vacuum forming

A packaged wet-dry vacuum system comes with an open-weave backing material, or space mesh, in two pieces, and a finer mesh polyester screen. Together they create the surface for the vacuum work and a space for water removal. A 2½in (63mm) nozzle attachment is provided for the wet-dry vacuum hose, together with a roll of waterproof sealing tape. Two pieces of Ultra felt, and a plastic drop sheet are also included.

1 Fit the two pieces of backing material together on a waterproof work surface, which should be 3-4in (7-10cm) wider all round than the mesh.



2 Place the finer mesh screen on top of the backing material.

3 Position the nozzle at one corner of the screen, and seal it to the table and screen with the tape. Your working

surface and screen must be completely dry to ensure maximum adhesion of the tape.



YOU WILL NEED

- waterproof table surface
- aqua-vac — wet-dry vacuum system — (available from hire shop)
- hose attachment (available from leading hand papermaking

suppliers)

- waterproof adhesive tape
- 2 layers screen/mesh: spacer mesh/polyester screen (available from leading hand papermaking suppliers)
- couching felt

- plastic drop cloth
- prepared pulp(s)

TECHNIQUES

- sheetforming
- couching
- paper casting (optional)
- pulp painting (optional)





4 Cover the screen with a layer of Ultra felt to support the work if you wish to remove it from the table after the

vacuum operation. Dampen the Ultra felt before you lay it down or commence work on it. The vacuum table is now ready.



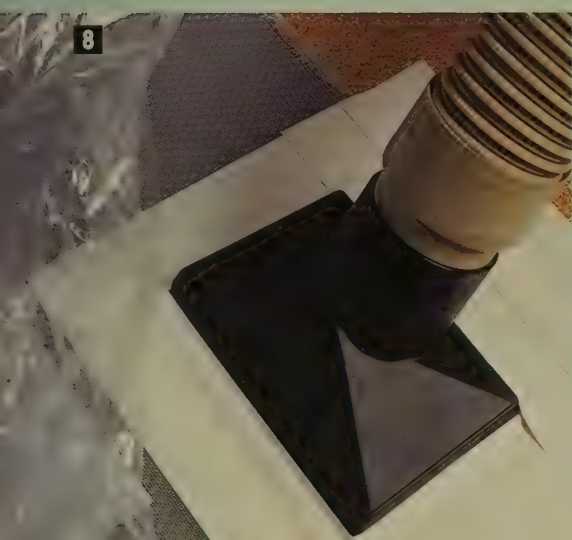
5 To see how the vacuum process works, first position a freshly made piece of paper on the Ultra felt.

6 Cover the paper with the plastic sheet, ensuring that the exposed edges of the table are wet. This is essential in order to achieve a good seal with the plastic. Any leaks or holes in the plastic will prevent the formation of a true vacuum.



7 Attach the wet-dry vacuum hose to the nozzle and turn on the cleaner. When the air beneath the plastic has been

removed and atmospheric pressure bears down, you will see the water begin to be drawn out towards the nozzle attachments.



8 Continue the vacuum operation until all the water which can be extracted with the pressure available has been sucked out. Remove the plastic sheet before you turn the vacuum system off.

9 When you have finished, empty the wet-dry vacuum cleaner, let the screen mesh material dry

before storing it (as flat as possible), and check that there are no holes in the plastic sheet.

◀ the traditional paper press. The creation of large sheets, embedding and lamination, embossed forms, works in relief, collage, and pulp painting can all be effectively accomplished using a vacuum table.

BUILD YOUR OWN SYSTEM

You can make your own vacuum system by using a wet-dry vacuum cleaner. A quality wet-vac develops 7-10in (17-25cm) Hg vacuum, which is about one third of the vacuum pressure of a deep vacuum pump. Probably the best approach to begin with is to borrow or hire the most powerful wet-dry vacuum cleaner available and order the smaller component parts from a papermaking supplier. A basic system provides enough materials for a work surface of 40×36in (100×90cm).

The system can be used on any flat waterproof surface, such as a wooden or Formica table top, or even a floor covered with a thick sheet of plastic. You may wish to make a frame, using strips of wood, to fit around the edge of the surface area. This will stop the water from running off the table and possibly flooding your work space. Do not forget to waterproof the frame and seal the seams where it is joined to the table.

VACUUM TABLE TECHNIQUES

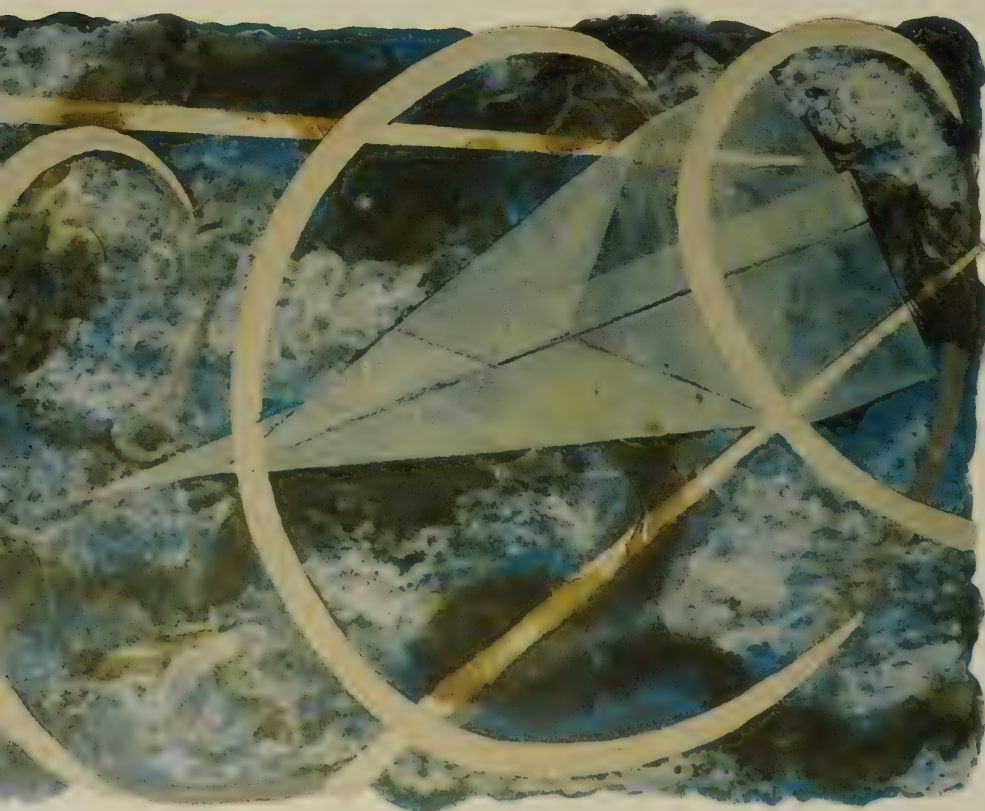
The vacuum table can be used for a wide variety of techniques. You can make a sheet of paper in a vat and couch it onto the Ultra felt as a base sheet for pulp painting techniques. Or you can work directly on the Ultra felt, perhaps sketching your design on it first. You can drain some of the excess water from

your pulp and spread it onto the vacuum table to create a rougher sheet. You can manipulate the pulp into different forms or embed different materials into it, concealing them with further applications of pulp or leaving them partially exposed.

Remember that this can be a face-down technique, working from the front of the piece to the back. If you want the piece to dry flat under restraint after the vacuum operation, place a slightly larger sheet of Plexiglass or Formica over the work before covering it with the plastic sheet. If the piece is particularly delicate, you can protect the surface from distorting under the pressure of the vacuum by placing a sheet of Ultra felt or a thin layer of foam between the work and the plastic sheet.

You can use the vacuum table for work with shallow relief shapes, including found objects, or casting moulds, using a low-shrinkage, lightly beaten pulp such as cotton linter. Styrofoam makes a good relief surface. It is easy to model in sheet form, the water can be drawn through it, and the work can be left to dry directly on it after the vacuum process has been completed.

You can apply additional pressure to the pulp, particularly in the case of relief work, by using a sponge or large stencil brush. Be careful not to damage the plastic sheet.



Pat Gentenaar-Torley: On the Way Up. Pulp painting created by pouring a variety of pulps and

then building up layered images on a vacuum table. 39×59in (100×150cm).

Paul Ryan: *Catalan*.
Pulp painting.
31×20in
(79×51cm).



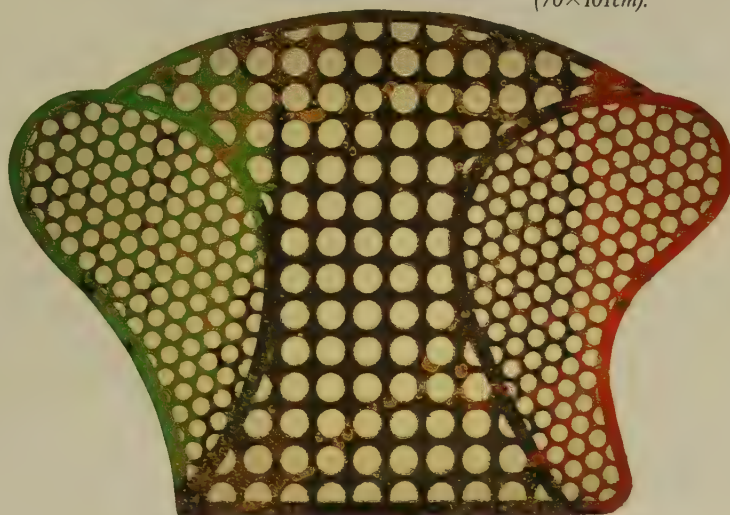
Gallery



Anne Vilsboll:
Dynamite. Pulp
painting. Handmade
kozo paper and
sprayed abaca pulp.
118×98in
(300×250cm).



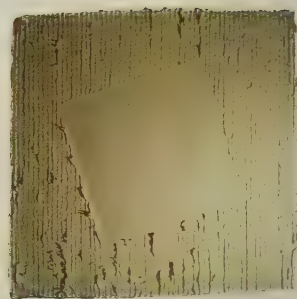
Judith Faerber:
Cacti. Handworked
paper pulp.
(24×20in)
(61×51½cm).



Laurence Barker:
Untitled. Pulp
painting. 27×40in
(70×101cm).

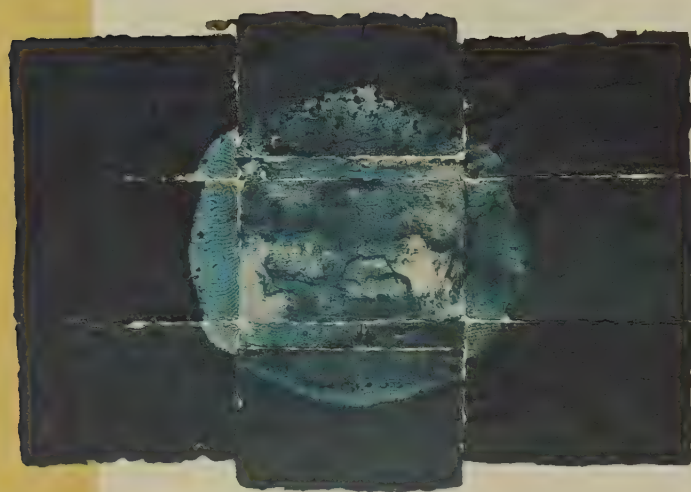


Julie Norris:
Scotland. Embossed,
recycled gampi tissue,
pastel. 28×26in
(71×67cm).



Kyoko Ibe: And the
Sea. Blind embossed
handmade paper.
71×71in
(180×180cm).

Gallery



Andreas von
Weizsacker: A Star is
Born. Watermarked
handmade paper.
61×38in
(155×96cm).

Therese Weber: O.T.
Handmade paper.
25½×29in
(65×75cm).



Peter Sowiski: Giff.
Coloured pulps, built
up in shapes and
overlaid laminations.
36×60in
(91×152cm).



*Prof. Dorothea
Reese-Heim:
Klangfiguren.
Handmade linen and
asparagus fibre paper.
35×39in
(90×100cm).*



*Jean Stamsta: Bird
Portrait. Recycled
paper, fabric, acrylic.
52×56½in
(132×143cm).*



*Beetroot paper made
from sliced cross-
sections of the
vegetable, laminated
by a process similar to
papyrus-making.*

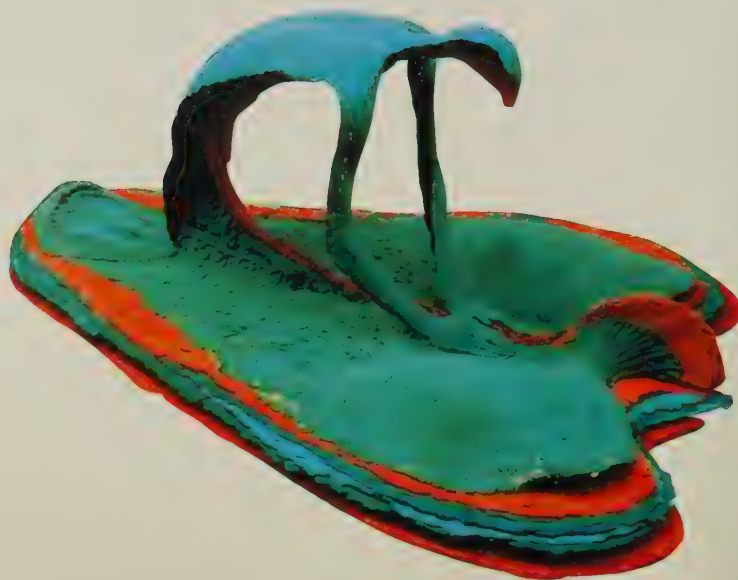
Sculptural Techniques



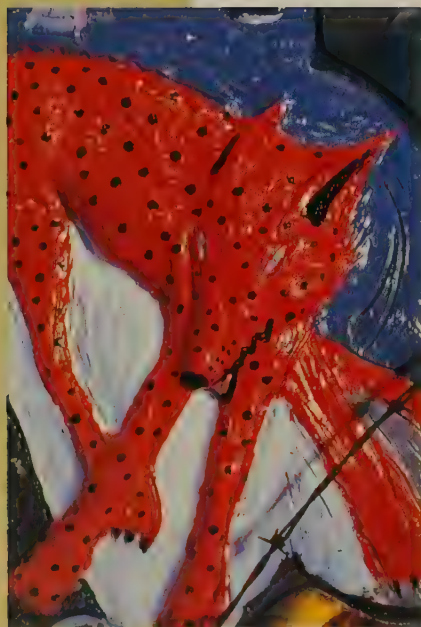
Ray Tomasso:
Bronze Tile Game
(Copper Version).
100 per cent rag,
cast paper.



*Jeanne Jaffe:
Gardener Series:
Bending Figure.
Cast, hand-
pigmented paper
layers. 28×61×48in
(71×155×122cm).*



Cast Paper



*Ted Ramsay:
Changing Courses
(detail). Cast
handmade paper,
enamel and wood.
37×32in
(94×81cm).*

One of the most dramatic developments to have extended the vocabulary of papermaking is a recognition of paper's sculptural potential. Its ability to assume almost any form and still be lightweight makes paper a perfect medium for creating three-dimensional work. The cost is minimal compared with that of most sculpture materials and the principles of casting paper are fairly straightforward. Many artists are attracted to paper for these reasons and have brought to it approaches from other crafts, such as the casting methods of sculpture or handbuilding in ceramics.

Innovative adaptations of these methods, coupled with an increased awareness of the options for preparing fibres and the handling properties of pulp, have enabled the creation of a tremendous number of intriguingly varied three-dimensional works.

Most paper sculpture is made by pressing prepared pulp, or by layering small pieces of lightly pressed paper, into a plaster or latex mould. Objects without undercuts, or areas where the paper can become trapped in the mould, can be cast using a simple one-piece plaster mould. An object "in the round" must be divided into sections for casting and the separate pieces assembled after the paper has dried. An object with undercuts can be successfully cast in a flexible rubber latex mould with a plaster back-up.

Your choice of fibre and method of pulp preparation are important. Bast fibres and seed fibres have different characteristics, which may be more appropriate for one casting technique than another. In general, it is worth noting that prolonged beating, particularly of herbaceous bast fibres (such as flax), results in a high-shrinkage paper ►

PROJECT

Making a Plaster Mould



2 Make a 2-3in (5-8cm) deep wooden frame to fit onto the base board (a simple box mould). This will determine the

thickness of the mould casting. The corner joints can be screwed to allow the frame to be taken apart and reused.

YOU WILL NEED

- Plasticine, modelling clay or 3-dimensional objects (without undercut areas)
- good grade plaster for mould making: U.S. Gypsum Moulding Plaster No. 1 or Georgia Pacific K59
- mixing bucket
- scales (for weighing plaster)

- sieve (for sifting plaster) (optional)
- mould release agent (vaseline, soft soap or buffed paste wax)
- formica covered board
- 4 lengths of wood
- 4 brackets and/or brass screws
- silicone sealer
- water sealant or linseed oil
- small brush

TECHNIQUES

- making a mould
- sheetforming
- couching
- pressing



3 Waterproof the frame and fill any gaps between the frame and the board with a silicone sealer.

4 Pour cold water into the mould, almost to the top of the frame. Measure the water from the mould into a mixing bowl or plastic bucket with a lip for pouring. The ratio of plaster to water is critical. Follow the manufacturer's (or the supplier's) instructions carefully. Sprinkle the pre-measured powder into the water. The plaster will begin to float as it displaces the water in the bucket. Wait for it to dissolve.

1 Choose a simple shape to cast from or make your own with modelling clay. Avoid undercut areas that might hinder the

removal of the mould from the cast. Model the clay directly on a Formica board. This can be used as the base of the casting

box. If the object to be cast is porous it should be waterproofed and treated with a mould release agent.



◀ with a greater degree of translucency than a shorter fibre pulp (such as cotton linter), or than the same fibre beaten for a shorter period. The nature of the fibre itself, the method of preparation and the style and duration of beating can all be adjusted to suit a variety of requirements.

Shorter fibres and low-shrinkage pulps may cause fewer casting problems,

but tend to require the addition of an adhesive agent, such as methylcellulose, for rigidity or strength. Longer fibres or high-shrinkage pulps may present greater shrinkage problems, but offer a wider range of casting possibilities. Shrinkage tests, based on variously prepared fibres, can provide a useful basis for developing further three-dimensional effects.

DRAMATIC VOLUMETRIC FORMS

You may have already noticed the tendency of a particular fibre to shrink or distort more than another, especially during the drying process. Sometimes the edges of a loft-dried sheet become cockled or part of a board-dried sheet lifts off the board before the rest of the sheet has completely dried.

The forces that occur within a sheet as

5 Gradually add the rest of the plaster. Leave for 20 seconds, or until it is saturated, then put your hand gently into the plaster and make a fist. Slowly unclench your hand and make a fist again several times. This will force out any lumps.



7 Pour the plaster into the frame from the lowest point in the mould until the object is completely covered and the mould is filled. The plaster will creep over the prepared object and thus reduce the risk of trapping air bubbles. Clean off utensils immediately as the plaster hardens and cannot be dissolved. Never pour

plaster down a drain or sink, because it can set underwater. During the setting process (27-37 minutes for No. 1 U.S. Gypsum), the plaster heats up. When it has cooled and the casting is hard, detach the frame and remove the plaster mould from the model. Clean off any clay from the mould.



6 When the plaster has been absorbed, the mixture should resemble dairy cream. Do not stir the plaster as this will cause air bubbles and fast setting. Slow setting creates a strong mould.





*Winifred Lutz:
Epiphenomenon
(Phase Transition).
Cast handmade flax
paper and pawlonia
log section.
45×120×31–50in
(114×305×79–
127cm).*

the hydrogen bonding between the fibres tightens are considerable. If the sheet is restrained during drying, these forces are kept in check. Most drying methods are based on this principle and are designed to minimize the undesirable effects of shrinkage. However, if the forces are allowed to resolve themselves freely, they can be used to create quite dramatic volumetric forms. Three- ▶

TECHNIQUE

Sheet Casting



1 Tear a small strip from a lightly pressed sheet. Tear against the edge of a ruler, or use a sponge to lift a section of the

sheet off the felt. Feathering the edges in this way ensures a strong, seamless bond.



2 Build up a layer of these pieces in the mould, making sure that the edges overlap. The pieces can be tamped into place with a short, stiff bristled brush. This will help to fuse the overlapping edges and ensure the reproduction of surface details.

3 The completed first layer.



YOU WILL NEED

- plaster mould or box mould with relief form(s) attached
- lightly pressed sheets of paper (low shrinkage pulp)
- sponge
- short, stiff bristled brush
- methylcellulose (or rice or wheat paste)
- small brush
- restraining form (optional)

◀ dimensional effects formed during drying can be manipulated in a number of ways: by couching two sheets with different shrinkage rates against each other and allowing the pressed laminated sheet to dry without restraint; by allowing one part of a sheet to dry faster than another; or by embedding extraneous non-paper materials between laminations of a high-shrinkage pulp to

create shrinkage counterforces within a single sheet.

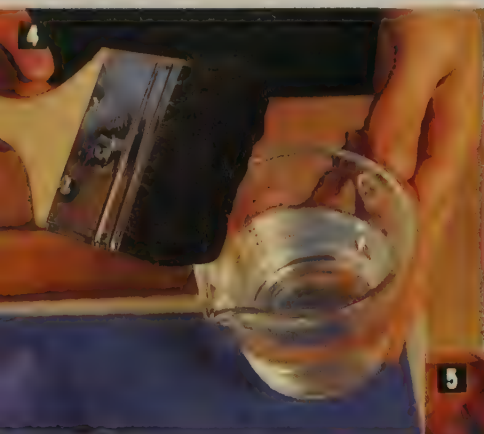
RECYCLED TRACING PAPER

Beating a fibre for high-shrinkage usually calls for a Hollander beater, but tracing paper offers a successful and readily available alternative to start with. Recycled tracing paper has a slippery consistency and a fairly slow drainage

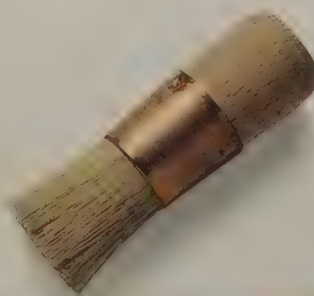
rate on the surface of the mould. Although its waxy, translucent appearance, is lost during recycling, it exhibits a high-degree of shrinkage if allowed to dry unrestrained.

SHEET CASTING

There are two distinct methods of applying pulp to a mould or relief surface to create a paper cast: sheet, or lami-



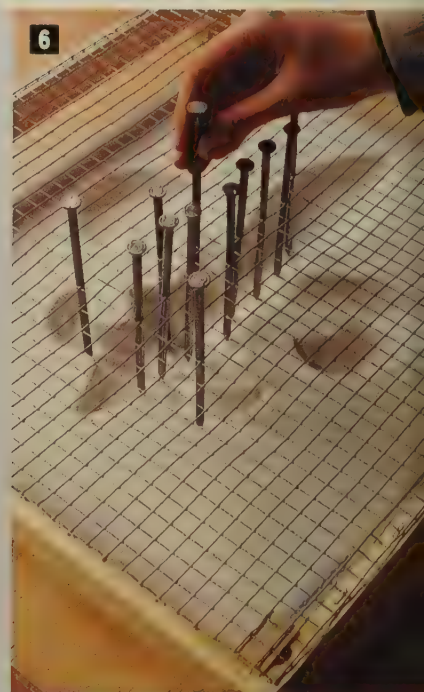
4 If you are using a short fibre, low shrinkage pulp, brush a thin coat of methylcellulose between the pieces of the first and second layer. This ensures adhesion between laminations and increases the rigidity of the casting.



5 The edges of the second and any subsequent layers should be overlapped and placed above a seamless area in the layer beneath. Several

thin layers will give a stronger cast than a single thick one. A thin first layer, using a plant fibre paper, can be backed with layers of a more

readily available or economically prepared pulp. Additional layers will increase the opacity of the casting.



6 If you have used a high shrinkage pulp you will need to hold the paper in place as it dries. You can use a heavier weight comparatively non-shrinking paper with methylcellulose for the final layer, or a plaster back-up, or rustproof weights.



Lillian A. Bell:
Under the table:
fought by metaphor.
Cast paper.
18×27×21in
(46×69×53cm).

nate, casting, and pulp casting. Both methods can be used in a plaster mould or in any other suitably prepared form.

Laminate casting is best done with freshly couched sheets of paper that have been lightly pressed. It involves layering pieces of paper into the mould and overlapping the edges where the pieces come together to achieve a seamless appearance. Sheet lamination can give a thin, ►

7 Leave the paper cast to dry in the mould. The plaster will absorb some of the water from the paper and hasten the drying time. Casting by this method seldom takes long to dry, but will depend on the number of layers and the humidity of the room. A fan can be used to assist the drying process.



8 When the casting is completely dry, separate it from the mould with a sharp knife.



9 Gently ease the casting from the mould until it is completely free from the plaster.



◀ light yet strong casting with potential variation in translucency and opacity.

PULP CASTING

Pulp casting generally requires quite large amounts of strained pulp and will give a thicker, more opaque result than sheet, or laminate, casting. A short fibre, low-shrinkage pulp, such as cotton liners, is most commonly used. Methyl-

cellulose, a flexible paper glue, is often added to strengthen the pulp and make the paper stiffer when dry (see p. 27). Like sheet casting, it can be accomplished using many kinds of relief surface, and there are numerous natural forms as well as manufactured objects which can be adapted to create an interesting mould. You can use the same basic box mould as for a plaster cast (see p. 101)

and attach the chosen forms to the base board. Foamboard is easily made into a simple relief surface. Some materials, such as wood will require sealing before casting to prevent any impurities from staining the pulp as it dries.

If you cast the relief using a plain pulp, you can apply paint to the work after it has dried and been removed from the mould. Alternatively, you might

TECHNIQUE

Pulp Casting



1 Cut out the elements that make up the relief.



2 Assemble the relief, using a waterproof adhesive.

3 Position the relief in the casting frame.



YOU WILL NEED

- box mould
- foamboard
- prepared pulp (low shrinkage)
- waterproof adhesive (silicone sealer)
- sieve
- sponge
- cheesecloth or muslin (optional)
- methylcellulose

TECHNIQUES

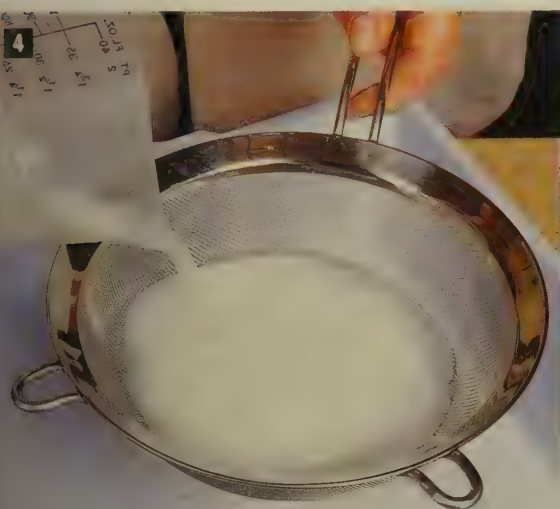
- making a mould box



*Nancy Thayer:
Temple View. Cast
paper and acrylic
paint. 57×43in
(145×109cm).*

combine different coloured pulps and include various embedments during the final stages of the casting process.

Pulp casting does not usually confer the same bonding strength as sheet or laminate casting. Although the pressure exerted when sponging the pulp in the mould compresses the pulp, it may be necessary to add a small amount of methylcellulose to the pulp beforehand.



4 Strain the pulp to an apple sauce consistency. Pulp casting requires a lot of pulp. It is better to overestimate the amount you need rather than run out halfway through.

5 Scoop a handful of strained pulp into the mould and pat it into place.



6 Continue to fill the mould with the pulp, patting it into place around the edges of the relief. Overlap the edges of the scooped pulp and layer several handfuls until you have built up a thickness of 1-1½in (25-37mm). Any air that becomes trapped during this process can be released by piercing the layers with a pointed tool.



7 Slight sponging between handfuls will help to create an even, well-bonded layer. If you need to reinforce the pulp, soak some pieces of cheesecloth or muslin in methylcellulose

and lay them between half-inch (12mm) layers of partially sponged pulp, making a sandwich of pulp, reinforcement, pulp.

8



8 Gently sponge the excess water from the pulp, working from the centre or highest points of the relief and moving out towards the edges.

9



9 Increase the sponging pressure as the pulp becomes more stable and the relief begins to emerge.

10



10 Continue until you have removed as much water as possible. The pulp will compact down to at least half its original thickness.

11



11 A half- to one-inch (12-25mm) casting can take several weeks to dry. Forced or uneven drying can cause shrinking and warping, so it is best to leave the relief to dry naturally without

the use of fans or heaters. Remove the frame and, when the piece is completely dry, lift the cast paper relief off the mould. You can keep the foamboard as part of the piece or remove it as required.

PROJECT

Volumetric Forms

YOU WILL NEED

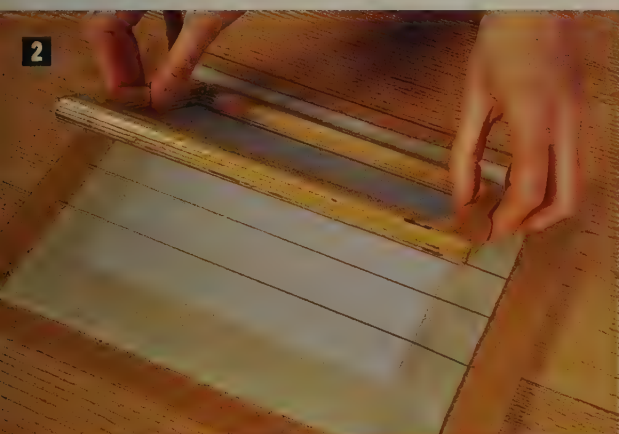
- prepared high shrinkage pulp, i.e. recycled tracing paper
- inclusions: thin brass rods (from model-making shop)
- mould and deckle
- couching cloths
- pressing boards

TECHNIQUES

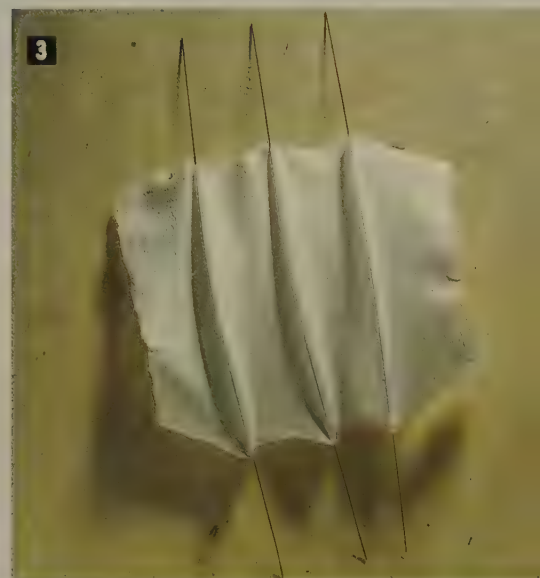
- sheetforming
- couching
- embedding
- laminating
- pressing



1 Couch a freshly formed sheet and arrange several thin brass rods across it. You can experiment with the number and spacing of the rods and with different materials, such as strips of plastic, thin wooden sticks, or a grid of cotton or linen thread. The degree of rigidity or flexibility of the non-paper inclusions will affect the displacement that occurs within the sheet as it dries.

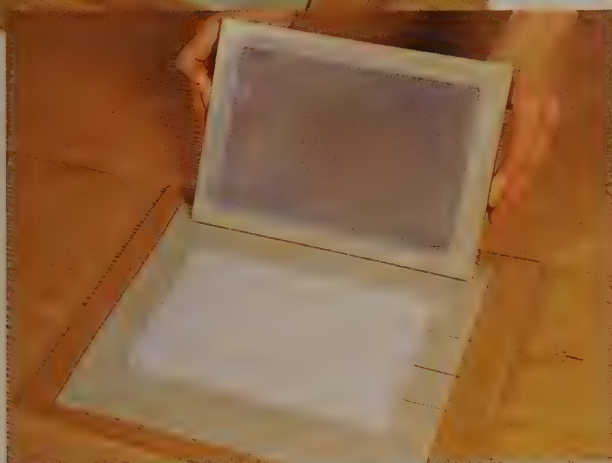


2 Couch a second sheet on top of the rods and base sheet. After pressing, remove the sheet from the felt and place it on a clean surface to dry. The sheet must be allowed to dry without being restrained, so do not brush or roller it onto the drying surface.



3 The paper will shrink as it dries, but the rods will not, and the sheet will therefore contract between them. Different shapes will be produced

according to the degree of shrinkage of the paper, the resilience of the inclusions and the way in which they cross the sheet.



Gallery



Jody Williams:
Escaping
Depressions. Cast
paper. 15×20in
(38×51cm).

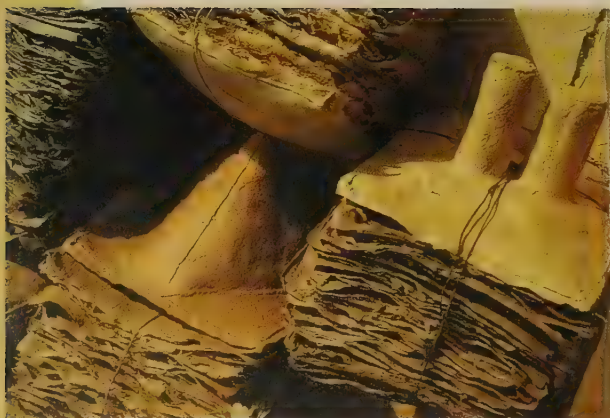


Cathrine Schei: Cut
IV and V. Cast
handmade paper.
12×24in
(30×60cm) each.

Lilian A. Bell:
Revolving Door
Policy. Cast paper,
mixed media.
59×44×26in
(150×112×66cm).



Ted Ramsay: Life
Strategy II. Cast
paper, enamel, wood.
46×46in
(117×117cm).

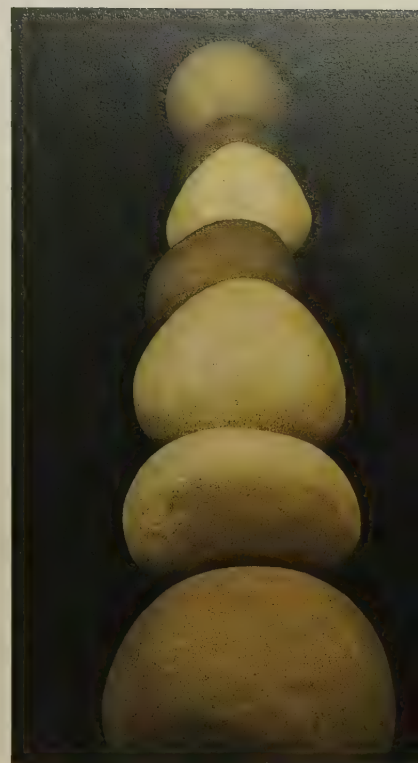


Josephine Tabbert:
Papierarchitektur
(detail). Handmade
paper. 6×16in
(16×40cm).

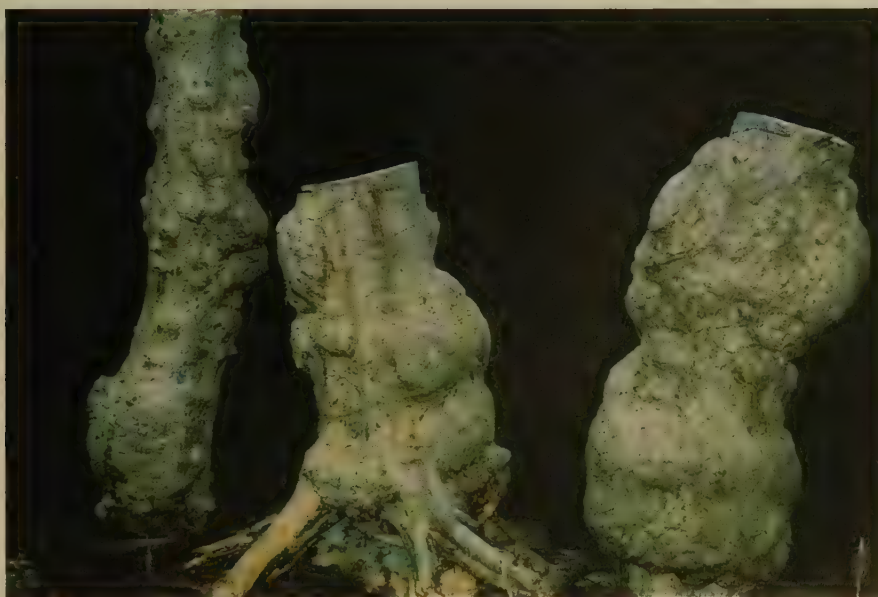




Jeanne Jaffe: Totem Series — The Three Muses. Cast handmade paper, oilstick, gouache. 82×84×18in (208×213×46cm).



Donna Koretsky: Around These Lines. Unbleached flax fibre applied to collapsible latex moulds. 7×84×7in (18×213×18cm).



Helmut Becker: Tree Skins: Totemic Tower, Totemic Burls, Totemic Roots. Spray cast fibre flax paper pulp.

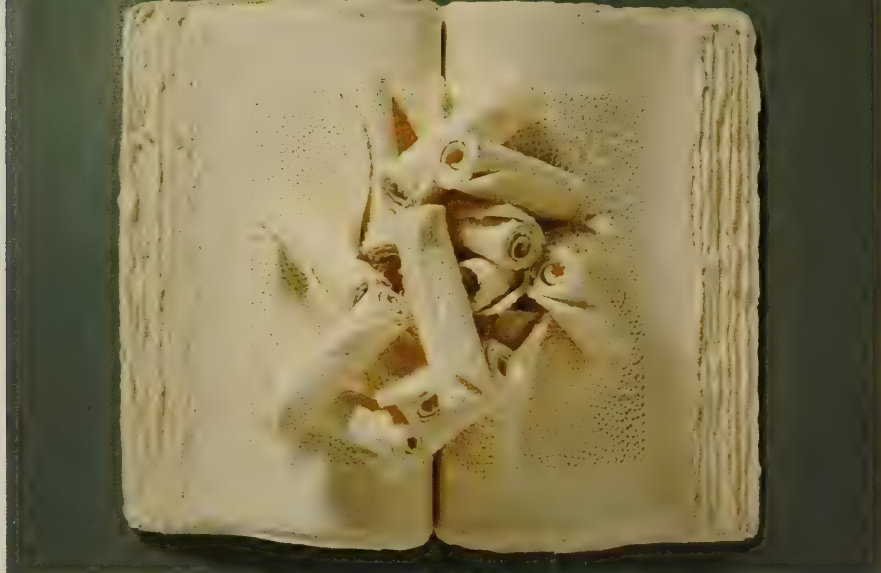
Contemporary Adaptations



*Guy Houdin: Patak
pense à Paul. Woven
strips of painted and
twisted brown
(kraft) paper.*



Vito Capone: *Libro-Sovrapposizioni*.
Book object made
from "carved" cotton
paper. 8×9×5in.
(20×24×12cm).



Paper and Books



A collection of books
with varied shapes,
sizes, bindings and
decorative covers.

Long before the development of paper, when various systems of writing began to replace the oral traditions and memorized texts of early peoples, "books" were used to record events, customs, codes of law, religious myths and rituals.

"BOOKS" OF CLAY

Clay tablets and rolls of papyrus are the earliest extant prototypes for the book as we recognize it. Clay tablets of various shapes and sizes were the main means of communication in Mesopotamia for nearly 3,000 years. The clay was inscribed while it was damp and soft, and either dried in the sun or kiln-baked to make it more durable. Although it was not possible to bind the tablets together, "books" were made up of several tablets, each named, numbered and carefully indexed. Clay "envelopes"

were often fashioned around the tablets to ensure their preservation.

BUTTERFLY BOOKS

In China, the earliest bound books were thin slips of bamboo or wood joined by cords. These gave way to silk (and later paper) scrolls. The inconvenience of unrolling a scroll to read a particular section was overcome in a number of ways. One of the simplest was to fold the scroll concertina fashion, attaching covers to the first and last sections. Sometimes the first and last pages were bound to a single cover, leaving the concertina pages free to flutter out from the binding (a "flutter" or "whirlwind" book). Later, to alleviate the stress on the folds of such books, single sheets of text were folded face inwards, stacked for binding, and pasted along the folded edges so that the pages stood out like the ►

PROJECT

Single-section Book

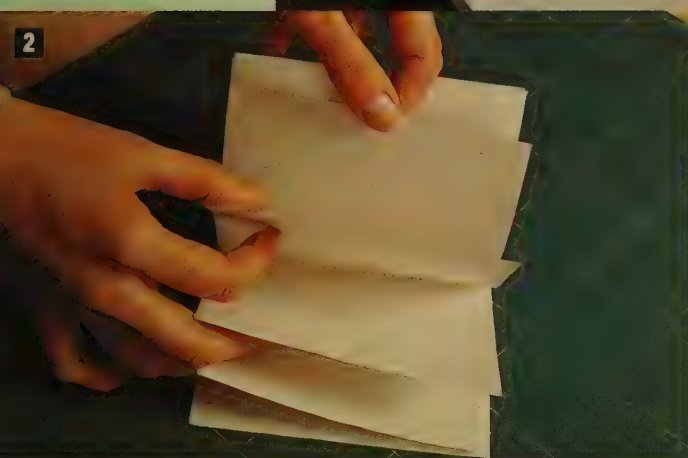
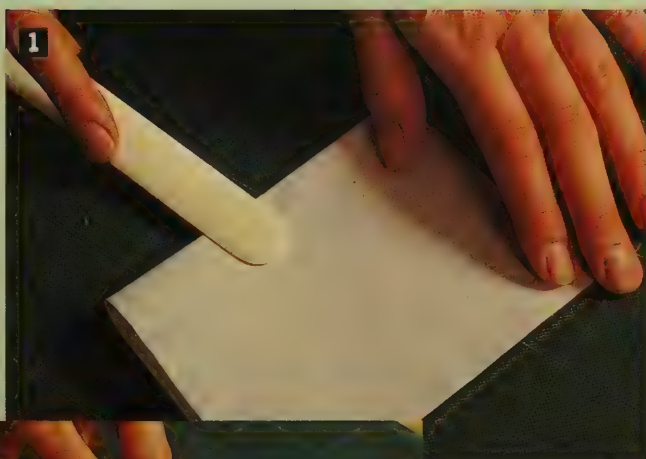
YOU WILL NEED

- a selection of papers (preferably handmade): not too thick for the inside pages slightly heavier weight for cover

- pencil
- ruler
- set square
- cutting board
- scalpel or craft knife
- short-eyed needle (large enough for

- thread)
- sewing thread (preferably linen)
- bradawl
- scissors
- bone folder
- bull dog clip

1 Take the sheets for the inside pages and fold each one in half, with the grain direction parallel to the fold (see p. 120). Use a bone folder to score the fold lightly.



2 Slip the folded pages inside one another to form a section. The top edge is the "head" and the bottom edge is the "tail". The open edge opposite the folded spine is the "foreedge".

3 The measurements for the cover should allow a $\frac{1}{8}$ in (3mm) margin beyond the page edges at the head and tail, and $\frac{3}{16}$ in (8mm) at the foreedge. This allows for the take-up when the cover paper is folded around the section, giving an equal $\frac{1}{8}$ in (3mm) margin on either edge. If the section pages are the same size as the cover sheet, trim them down slightly before you fold them. If you

want to keep the deckle edges of the pages, however, you will need to choose a larger cover paper and cut it down to give the marginal overlap described above. Use a set-square to make sure you get right-angled corners, and a ruler to measure straight parallel edges between the head and tail, the spine and foreedge. Remember to check the grain direction before you cut the paper.

4 Fold the cover paper in half along the grain and score the fold with the aid of the bone folder. Do not press too hard or you might stretch or mark the paper. A

light but firm pressure along the length of the fold is all that is needed. Slip the section inside the cover, leaving an equal margin at the head and tail.



◀ wings of a butterfly when each one was turned (a “butterfly” book). This marked the beginning of the shift away from the scroll and concertina format towards the book shape exemplified by the parchment or vellum manuscript volume.

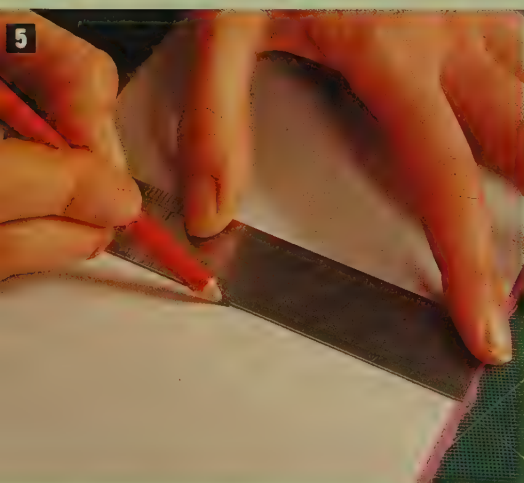
JAPANESE BOOKS

The essentials of Japanese book production were inherited from China. Scrolls,

concertina or accordion books, album and “butterfly” books were all based on Chinese models; but during the 11th and 12th centuries, the development of a multi-section stitched binding (*retchoso*), curiously similar to Western binding of folded sections, was unique to Japan. Several sheets of paper were stacked and folded in half to form a section and a number of sections were stitched together through the central folds.

POUCH BINDING

Today, characteristically Oriental-style books are produced by pouch-binding, which replaced other methods in China and Japan during the Edo period (1603–1868). The pouch-bound book (*fukuro toji*) consists of sheets that are folded in half and stitched through the edge opposite the fold. Each page forms, in effect, a pouch that is open at top and bottom. The text is, therefore, written or printed

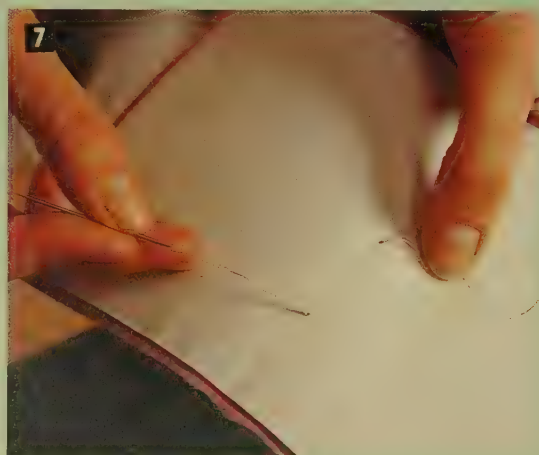


5 Open out the book to the inside (“gutter”) fold. Find the mid-point of the gutter fold and mark it lightly with a pencil.

6 Mark two holes on either side of the mid-point, 1in (25mm) from the top and bottom edges of the section. Then, making sure that the pages are still in position, prick three holes straight through the pages and the cover at these points, using the bradawl.



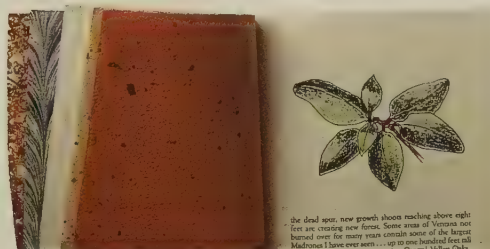
7 Cut a length of thread (approximately two-and-a-half times the length of the section) and thread the needle. Holding the cover and inside section together so that the pages do not slip out of position, start sewing from the inside of the book by passing the needle through the centre hole. Hold the tail of the thread with your thumb against the middle of the book. Return the needle from the outside through the top or bottom hole.



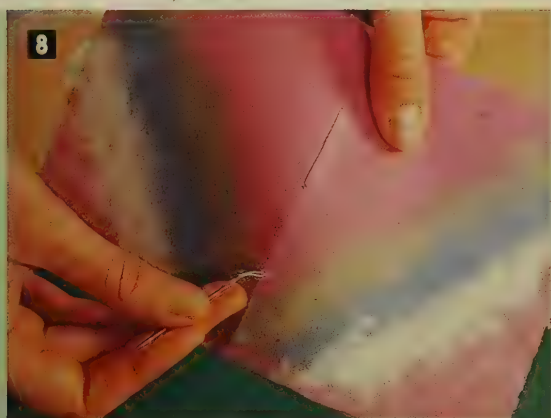


Kathy Crump: Bald Eagles in Ventana. An oriental style binding with handmade paper

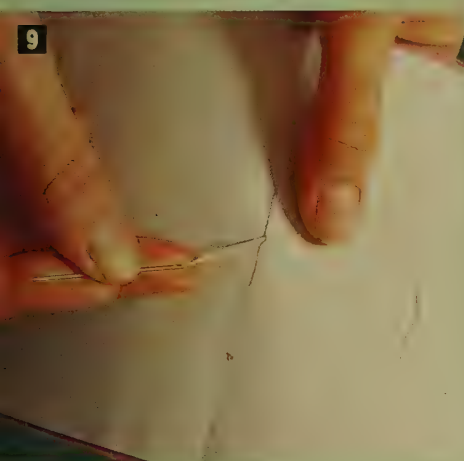
covers of philodendron fibre over abaca (left) and sample pages (below).



on one side only. A thin sheet of card can be inserted into the “pouch” to prevent water-based ink from bleeding through to the other side of the folded page. The commonest type of pouch-bound book has a straightforward sewn binding with stitching holes at four points along the spine, but more elaborate stitching patterns, sometimes with decorative inserts along the spine, are also used to good effect. Unlike traditional Western books, ►

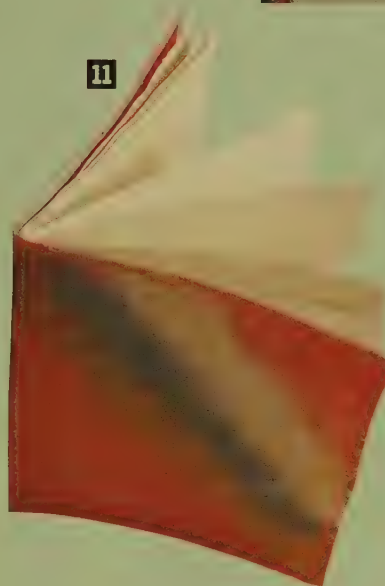
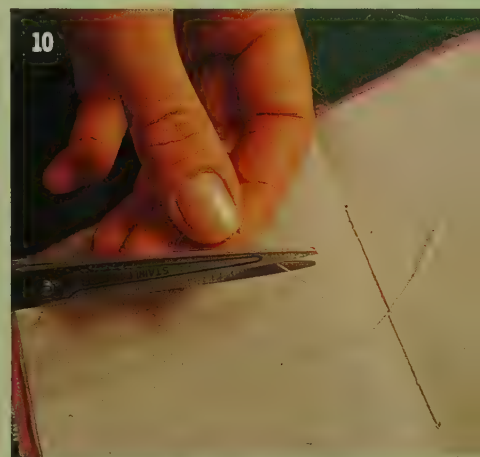


8 Pass over the centre hole and take the needle out through the other hole.



9 Return the needle through the centre hole so that the thread comes up on the opposite side of the long centre stitch from the tail of thread you have been holding with your thumb.

10 Pull in the thread on either side of the long centre stitch and tie it securely using a reef knot. Cut off the loose ends to about $\frac{1}{2}$ in (12mm).

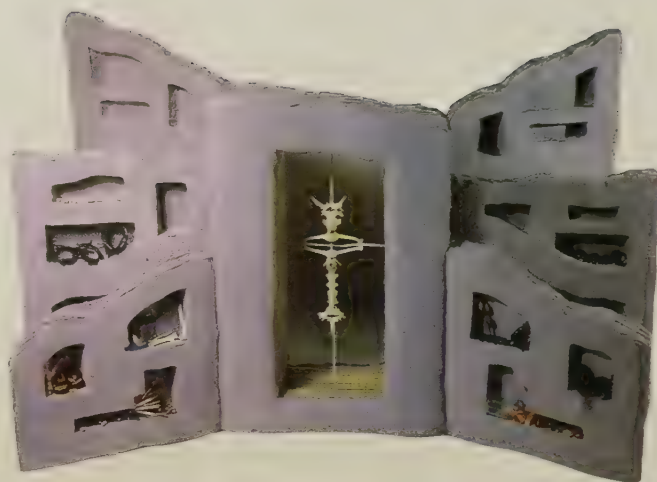


11 You might prefer to reverse the order of sewing a single section by starting from the outside of the book. The ends of the thread are then tied on the outside spine and can be turned into a decorative feature.

◀ the Japanese pouch-bound book usually has a soft cover.

THE BOOK AS OBJECT

The book has always been a powerful object, revered for its ability to disseminate knowledge and proclaimed as a symbol of truth. The book has also been feared and reviled, and many a book has been burned, drowned, censored or suppressed. The outward appearance of the



Dianne L. Reeves:
Cause for Interpretive Dissension (front and back views). Hand-made paper of dyed sisal, bones, scales and pods.
25×12½×15½in
(63×32×40cm).

PROJECT

Japanese Pouch Binding



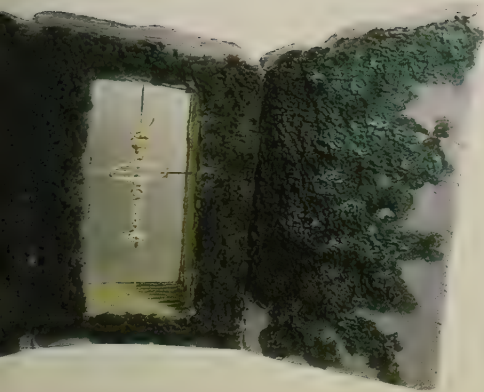
1 Fold each page in half, with the grain direction parallel to the fold. Score the fold lightly using a

bone folder. Then assemble the sheets with the folded and open edges corresponding.

2 Ensure that the folded edges are aligned by knocking them down against a flat surface.



3 To trim the deckle edges place the block of folded sheets on a flat cutting surface and use a ruler and sharp cutting knife to trim the head and tail at right angles to the folded fore-edge. You may find it helpful to place a weight on top of the pages to prevent them from slipping while you trim them and mark them for binding.



book has altered over the centuries but its basic format has long remained unchanged.

In recent times, however, artists have re-examined and extended the definition of a book. Where the visual and tactile qualities of the book override its content, the book has become a work of sculpture. It can be a game, a toy, a conceptual vehicle; the typography and inner dressing of the book can be dis-

torted to a degree of illegibility — it can remain a “closed” book; or techniques of paper engineering can transform it into a pop-up construction or performance piece; there can be a unity between the meaning of a word, its typographical form and the shape of the book — or the cover can be used to belie the contents. The familiar space of an open book becomes the stage for the dynamics and disclosures of a performance. ►

4 Hold the knife vertically against the ruler and cut through one or two pages at a time. Use a set square to check that all the corners are

right angles, and measure the distance between the spine and foreedge to ensure that they are parallel before you proceed to trim the spine.



5 Position a ruler $\frac{3}{8}$ in (1cm) in from the edge of the spine and mark two points $\frac{5}{8}$ in (1.5cm) from the top and bottom edge.

6 Measure the distance between these two points into three equal sections and mark up the two further dividing points. Use a bradawl to pierce four holes straight through the block of pages at the marked points.



◀ MAKE YOUR OWN BOOK

The techniques involved in making a book and the skills required to decorate it and to design and print the text and illustrations were fully developed by the 16th century. Each element of the traditional handmade book was, however, a specialist trade, and sometimes even a protected one. It was only with the emergence of private presses as part of the Arts and Crafts Movement in Eng-

land during the late 19th century that the tasks of papermaking, printing and binding were combined. Nowadays new techniques and the expansion of printing technology in areas such as photocopying, computerized graphics and quick binding, mean that many elements of the handmade book are no longer “trade secrets”, and that anyone can make a book — out of almost any material.

This section presents two simple but

effective methods of making a book, for which the minimum of sewing and binding equipment is required. You may use papers of any kind, as long as they are not too thick. The format of your book will be determined by the shape, size and grain of the paper you use.

FINDING THE GRAIN

Before you begin any binding operation — even if you are only folding a sheet to

7 Cut two pieces of paper for the front and back cover and fold them in half. (You can fold and trim them with the pages, so that they match exactly.) The grain direction of the

cover and inside pages must correspond. Use one of the pages as a template, align the edges, and mark corresponding sewing holes in both folded cover sheets. The

holes in pages and cover should be large enough for your needle and thread to pass through three times.



8 Position the covers on either side of the block of sheets. Place two small pieces of card against the middle of either foredge and secure them with a bulldog clip. This will prevent the pages and cover from slipping out of place whilst you are sewing.

9 If you want to make a special feature of the binding, use a coloured silk or embroidery thread to sew the book together. It should be about three-and-a-half times the length of the book. Start

sewing from one end of the book, using a running stitch to reach the opposite end. Hold the tail of the thread with one hand against the side of the book as you sew.

try out different page sizes, or wrapping a cover experimentally around a book — you must establish the grain direction of the paper.

The grain direction refers to the orientation of fibres in the paper, much like the grain in a piece of wood. Although it is widely believed that Western handmade paper has no grain direction, it is virtually impossible to form a sheet in which the fibres are

aligned equally in all directions. The grain direction can be determined by one or more of the following indices:

- A sheet of paper will tear more readily along the grain than against it.
- A sheet of paper will fold more easily in line with the grain than across it.
- Paper shrinks and expands more in one direction than another and, when moistened on one side, will curl parallel to the direction of the grain.

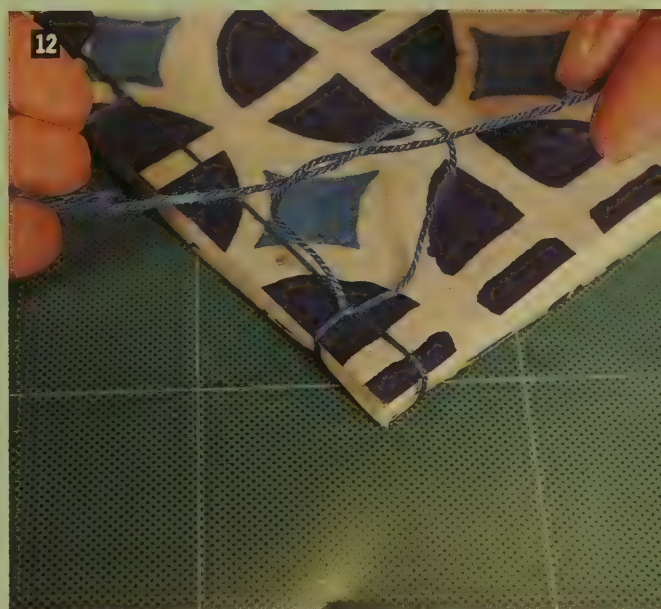
Ignoring the grain in paper can result in badly registered printing, or a book that will not open properly. The grain of all the materials in both simple and more complex binding operations must run in the same direction and should be parallel to the spine of the book.

10 When you reach the last hole, take the thread around the end of the book and return the needle through the same hole.



11 Then make a stitch around the spine and come back through the same hole once again. Sew back along the length of the book, this time passing the thread around the spine at right angles to the running stitch at each hole. You should finish through the same hole as you started from.

12 Tie the two loose thread ends into a neat reef knot close to the last hole. Then take the needle down through the hole so that the knot disappears into the spine. Cut off the ends of the thread as close to the hole as possible.



Obi sash woven by Sadako Sakurai who is one of the few remaining Shiroishi Shifu weavers in Japan. Once spun, the paper thread is dyed and then woven with either a silk or cotton warp.



Paper and Textiles



Kinujifu kimono by Sadako Sakurai. It takes her several weeks to make enough material for a single kimono.

In Japan, one of the most distinguished uses of paper is in the making of fabric for clothes. The first paper garments were made by Buddhist priests in the 10th century and called *kamiko* (from the words *kami*, paper, and *koromo*, a priest's robe). Kamiko robes are still made and worn by Buddhist monks for ceremonial purposes at the Todai-ji Temple in Nara.

Kamiko is made out of kozo paper, which is treated with a vegetable starch called *konnyaku*. The process renders the paper strong, pliable and waterproof. The sheets are glued together to form lengths of paper fabric which can then be cut and stitched. Kamiko was made into outer garments, such as coats and jackets, as well as vests and underwear. It was a popular form of clothing among the poor and was greatly valued for its warmth in winter. The wealthier nobility wore dyed, stencilled and

embroidered kamiko of great elegance for both everyday and ceremonial wear. Household items, such as pillows and blankets, were also made out of kamiko.

WOVEN PAPER FABRIC

In contrast to non-woven kamiko, the paper fabric known as *shifu* (from *shi*, meaning paper, and *fu*, meaning woven cloth) is made by weaving twisted strips of paper. The craft of weaving with paper was first recorded in Japan in 1638. It originated among peasant farmers, who made paper during the winter season, and skilled weavers, who developed a technique for manufacturing paper thread. The thread was dyed and used as the weft, with cotton the commonest choice for the warp. Other forms of shifu include *kinujifu*, made with a paper weft and silk warp; *asajifu*, which has a paper weft and linen warp; *morojifu*, ►

PROJECT

Shifu

YOU WILL NEED

- handmade or collected papers (as recommended)

- pencil
- ruler
- cutting board
- scalpel or craft

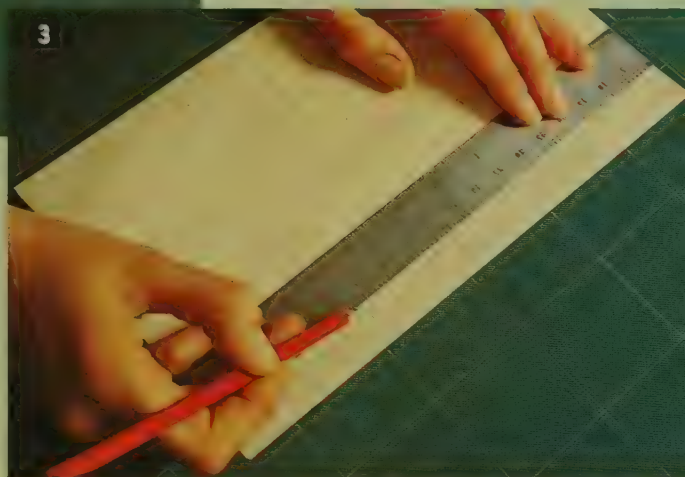
knife

- cotton towel
- bobbin winder (or spinning wheel)

2 Fold back the two ends in opposite directions so that they overlap the first folded edge by about $\frac{3}{4}$ in (2cm) and form a W-shape. Several sheets of paper can be folded together in this way.



1 Fold a piece of paper in half with the grain of the paper perpendicular to the folded edge. (To find the direction of the grain, tear a test sheet two ways, down one side and across the other. The paper will tear more easily along the grain.)



3 Place the folded sheet of paper on a cutting board and measure equal widths along the top and bottom edges. A quarter-inch (6mm) width is best to start with.



4 Cut from the inside fold (top to the two folds (bottom), taking care to cut just through but not beyond the

inside fold (leaving the $\frac{3}{4}$ in (2cm) selvage uncut). Unfold the paper and check for any uncut parts.



5 Open the paper out and lay it on a damp (spun-dried) towel. Fold the towel over the paper and place it in a clean plastic bag. Leave the paper for 7-8 hours or overnight. Several sheets can be dampened together.

◀ woven with both a paper warp and weft; and *chirimenjifu*, a crêpe-like fabric.

During the Edo period the wives of farmers and fishermen recycled kozo paper from used account books to make shifu working clothes. A finer cloth, considered as valuable as silk, was made in Shiroishi City by samurai family members for the Japanese nobility and given as presents to high-ranking officials. Traditional shifu garments include the kimono, haori (a short jacket), and

obi (the wide sash worn over the kimono). Twisted paper thread was also woven for handkerchiefs, tablecloths and even mosquito netting.

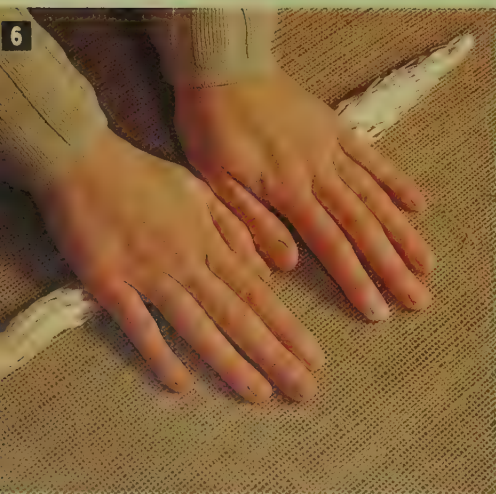
The technique for making shifu thread is simple and ingenious, but requires a certain amount of perseverance and practice. Almost any kind of paper may be used, although some are resistant to the twisting process and others will not be strong enough to withstand it. Handmade Japanese shifu



Shifu hand woven by textile designer Sally Anne Watt using mercerized cotton and silk warp and plyed paper weft thread.

6 Remove the softened paper carefully, holding the sheet by the uncut ends, and place it on a porous cement block or other slightly rough surface, such as carpet backing. Traditionally, round

river rocks or *tatami* mats provided the rolling surface. Using the palms of both hands, gently roll the paper strips across the surface and back again. Repeat this five times.



7 Remember to shake the sheet every so often during the rolling process to straighten the strips. Lift the sheet and separate any tangles with a sharp tug so that the strips are parallel.

8 Then put the sheet back and start rolling again, gradually increasing the pressure until the paper begins to twist. This may take about ten minutes and must be done quickly before the paper dries out.



paper provides a particularly strong paper thread because the mould is only shaken from front to back during the sheetforming process aligning the fibres in a single direction. This ensures the structural strength the paper needs when it is cut into fine strips and pre-spun.

Begin with your own paper, if possible, made by the Japanese sheetforming method. The best papers to use are Japanese handmade papers. They should be free of any imperfections: tiny bits of

bark make it more difficult to cut the paper. Alternatively, experiment with a selection of different papers, such as thin gift wrapping paper, computer paper, or dress pattern paper. Each will handle differently and produce an interesting variation of pattern and texture. Printed papers produce an especially interesting "ikat" effect when woven with a plain warp thread.

In most cases, shifu fabric is woven with a cotton or silk warp thread and a

paper weft thread. To weave coloured stripes or patterns into shifu cloth on a simple hand loom, you can either dye the paper thread, or use a coloured paper to make the thread.

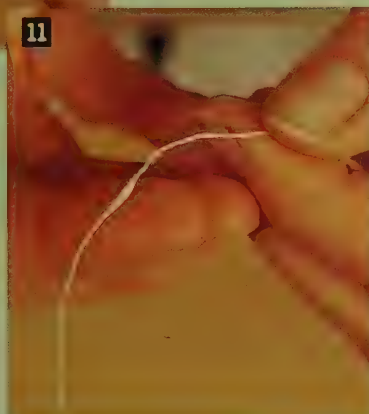
9 Tear through the uncut edges alternately on the top and bottom selvage to create a continuous thread.



10 The remaining untorn joints, or "seeds", can be torn down to $\frac{3}{4}$ in (1cm) and twisted back on themselves.



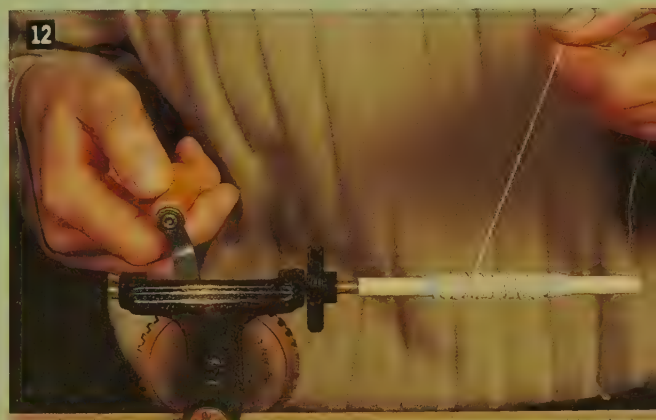
11 The thread will be slightly thicker at each of these points, and this is a characteristic feature of shifu fabric.



12 Spinning the paper increases its strength and can be used to join thread from separate sheets. Attach the end of the

thread to the bobbin or paper quill on the winder. Begin spinning by turning the wheel slowly with one hand and holding

the paper thread in the other hand between your forefinger and middle finger, supporting it with your thumb.



13 Extend your arm away from the winder along the thread as you turn the wheel. When the spun paper is at an arm's length from the

winder, wind it steadily onto the bobbin. Raise the thread vertically as you reel it onto the bobbin winder to prevent it from

untwisting. Then spin another arm's length of thread as before. Once spun, steam the thread on the spool for 20 minutes to stabilize the twist.

Helena Sellergren:
Mandala of Light.
 Paper, metal net and
 metal. 31½×31½in
 (80×80cm).

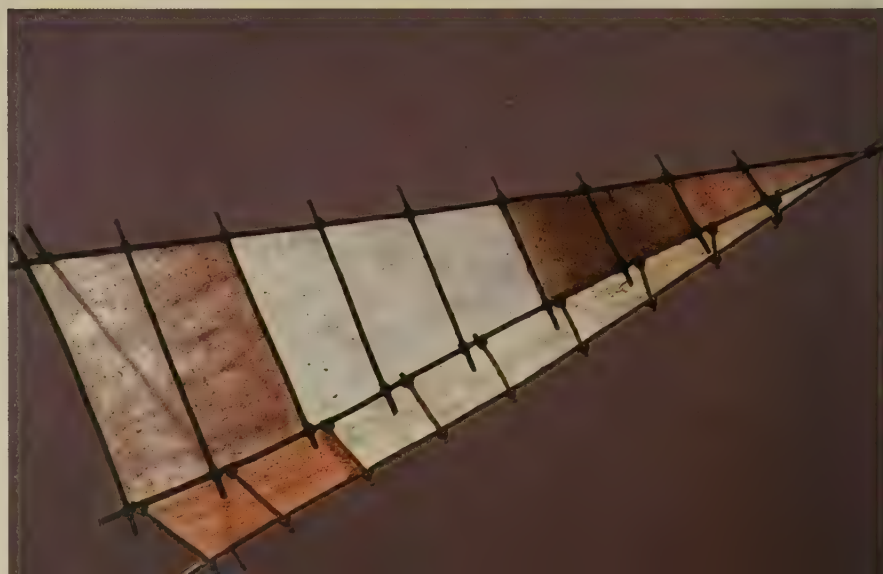


Paper and Light



Annette Sauermann:
Installation Licht-fallen. Paper on steel
 string construction.
 20ft (6m), (above).

Jane Balsgaard:
Paper Sculpture.
 Handmade paper
 and willow.
 23½×39×17½in
 (60×100×45cm).



Japanese handmade paper is remarkable for its combination of lightness, translucency and exceptional strength. These qualities have been an important element in the construction of traditional Japanese houses. Sliding *shoji* doors and windows are made with paper and allow a diffused light to enter the room. *Fusuma* (room dividers) are also covered with decorative paper such as *uchigumo* (cloud paper). Paper lanterns use the

light-transmitting qualities of *washi*.

Lightness and translucency make paper an obvious choice for lampshades, screens and blinds. By watermarking, or laminating or embedding decorative elements in a handmade paper, you can control the amount and quality of transmitted light. Those areas with fewer layers will allow more light to pass through. Variegated textures and layers of colour will enhance this effect.

PROJECT

Making a Candleshade

This project is based on an early European design. The shape is a simple one and can be copied by folding a sheet of plain paper around a small lampshade and

cutting out a template. Scale the template down, if necessary, to fit the holder that will support the candleshade. Apply a fire retardant in the final stages of making the shade. Fire retardant aerosol sprays are available from most theatrical

suppliers. They are manufactured for specific fabrics and you should use one which is suitable for paper. Follow the manufacturer's instructions for use.



YOU WILL NEED

- prepared pulp:
- 2 colours
- mould and shaped deckle
- adhesive labels or similar (for experimental watermarks)
- couching cloths
- pressing boards
- adhesive: PVA or stick-flat glue
- fire retardant

TECHNIQUES

- sheetforming
- shaped paper
- experimental watermarks
- couching
- laminating
- pressing

1 Make two shaped deckles according to your template. One should be slightly smaller along the curved outer edge. Make one sheet of paper using the larger

deckle and couch it onto a dampened felt. Then attach a watermark device to the surface of your mould within the smaller deckle shape.



2 Make another sheet with the smaller deckle, using a different coloured pulp.

3 Position the sheet on top of the larger piece and couch it (see p 57 for register).

4 The longer curved edge of the blue piece sits slightly inside the larger gold sheet creating a simple eye-catching border.



5 When the pressed paper is dry, glue and join the edges.



6 The watermarked blue paper forms the outer side of the shade. Spray the finished shade with fire retardant and wait for it to dry before lighting the candle.

7 When the candle is lit, the gold paper will shine through the design of stars.



Karen Stahlecker: *In Memorium: The Sacred Grove*. Handmade kozo paper and mixed medium. 9×14ft (2.7×4.2m).



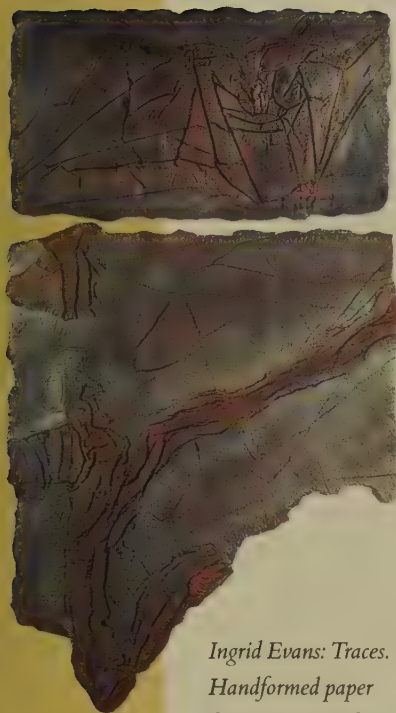
Paper and Nature

For many artists who work with paper, the transformative nature of the material and the cyclical process of papermaking are a direct source of inspiration. Papermaking itself, from the preliminary identification, gathering and preparation of plant fibres to the creatively charged moment when a sheet is lifted from the vat, is perceived as a metaphor for life-growth cycles found in nature. The layering of sheets during couching and the simultaneous bonding of various elements during pressing are a reflection of geological events. The contradictory combinations found in nature are

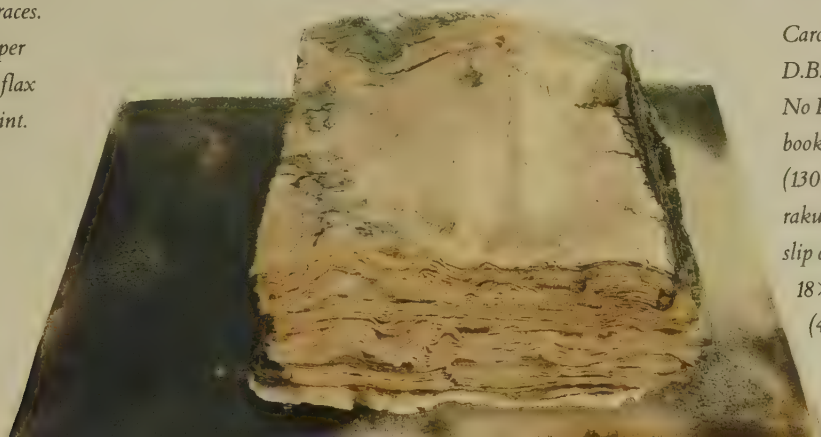
echoed in the fragility and strength, the smoothness and roughness, the translucency and opacity, the flexibility and structure of paper.

While the ritual traditions associated with paper and the meditative process of papermaking have appealed to many artists, paper's role as a natural reusable material has made it an attractive medium for addressing an increasing concern with more responsible use of the earth's resources. Throughout its history, paper has been a recycling medium, from the sheets made of hemp remnants and fishing nets in China to the use of ►

Ingrid Evans: *Traces*. Handformed paper from cotton and flax fibres, acrylic paint. 72½×39in (184×100cm).



Carol Farrow: *To D.B. This Story Has No End*. China clay book fired at 2372°F (1300°C). Glazed, raked, sawdust fired slip cast base. 18×18in (46×46cm).



◀ linen and cotton rags in Western papermaking. Today, old, discarded papers are digested into new creative forms and placed in fresh situations, transcending yet never quite losing the traces of a former existence.

CLAY PAPERS

There can sometimes be surprising affinities between natural materials — even if one is a mineral and the other a vegetable substance. For example, the

translucency of porcelain clay and the rate of shrinkage as it dries can be compared to the same attributes in various plant fibres used for papermaking.

Paper and clay may seem unlikely companions, but they have a functional as well as an aesthetic connection. Sometimes, China clay is used to coat the surface of a sheet of paper to make it more receptive to a particular printing method. Or it can be mixed with the pulp as a filler to make the paper more



PROJECT

Making a clay sheet

YOU WILL NEED

- undyed pulp (partially prepared or recycled)
- finely ground clay (from ceramic suppliers) or local earth pigments
- mould and deckle
- scales

TECHNIQUES

- sheetforming

2



1 Weigh the clay before adding it to a beaker of fresh water. You can adjust the percentage of clay to pulp according to weight. An approximate guide is 5 tablespoons of clay to 1lb (454g) [dry weight] of fibre. This will vary depending on the nature of the fibre.



2 If the clay is in solid form, break it into smaller pieces. Stir the solution occasionally until the pieces have dissolved.

Anne Viltsboll: from the series: *Tropism – Invisible Growth*. Handmade paper in natural colours.

41×33½in (105×85cm), (left).

Jane Balsgaard: *Man*. Paper stretched over steel rods. 118×79×59in (300×200×150cm), (right).



opaque. Japanese clay papers — such as najio maniai-shi (gampi paper with clay) — are famous for their colours: green (kabuta-tsuchi), yellow (tamago-tsuchi), creamy white (tokubo-tsuchi), and brown and dark grey (jakame-tsuchi). “Tsuchi” means earth, and the colours come from mixing different local clays in the papermaking process. The sheets have the smooth, velvety surface which is characteristic of clay papers. ►

3 Strain off the liquid, leaving the residue of softened clay. Repeat this rinsing process several times and then add enough fresh water to turn the clay into a thin slurry.



4 Pour the liquid into the vat with the prepared fibres to make the pulp solution. Clay tends to settle at the bottom of the vat, so thorough mixing is essential.

5 Make your sheet of clay paper with the mould and deckle in the usual way.



◀ VARYING TEXTURES

To make your own clay papers, you can experiment with different types of clay and, by varying the type and percentage of clay in the pulp, produce a range of surface textures from soft to hard, or fine to rough. For example, less finely ground clays will give a gritty surface to the paper. The nature of the fibre will also vary the character of the sheet.

If you are interested in the effects of natural pigments, you may wish to



Golda Lewis:
Irradiated Fragment
(Great Jones St.
series). Clay and
paper. 19×16in
(48×40cm), (left).

Golda Lewis: *Gift of
the Spirit* (East 16th
St. series). Terracotta
and paper. 22×30in
(56×40cm), (right).

PROJECT

Layering

YOU WILL NEED

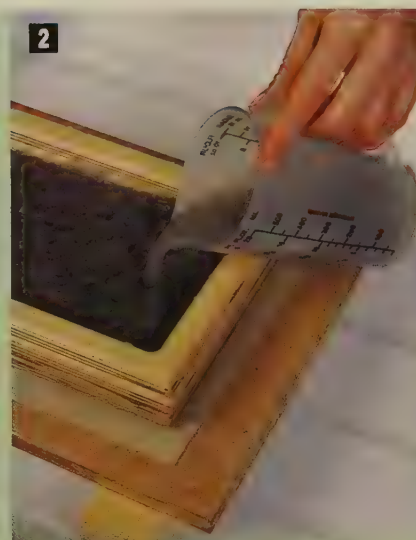
- coloured pulps using natural earth pigment
- bandsaw
- sandpaper
- mould and deep deckle
- shallow tray

TECHNIQUES

- colouring and other additives
- pulp pouring



1 Cover a couching board with an absorbent cloth and place it on a raised platform in a shallow tray. Position a mould and deckle, or a deeper frame (you can place several deckles on top of one another), in the middle of the board.



2 Strain each pulp into a jug and pour the first type into the frame, filling it to a height of about half an inch (12mm).



3 Let the water drain through the mould and then use a sponge to remove the excess water and press the pulp into place.



explore the tones from a range of clays or earth types. Each will have its own personality and history to contribute to the papermaking process, just as recycled papers and papermaking fibres do. Several types of clay are readily available from ceramic suppliers. Kaolin (China clay) is almost pure white, ball clays can vary from cream to grey, feldspars from pale pink to pale green. You might try clays which are prepared specifically for use as pottery glazes as slip deposits on

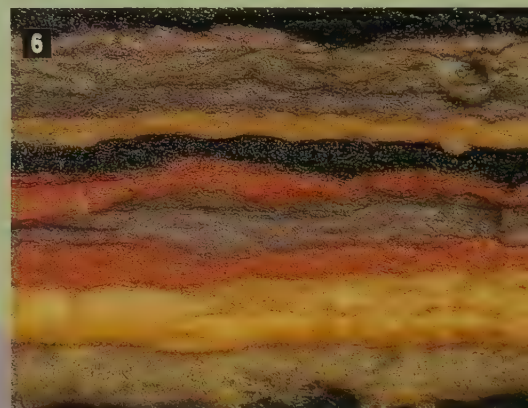
the surface of your paper, or if your local soil has a high clay content, you could dig your own supplies.

Sometimes an undesirable element — for example, a high percentage of iron oxide — mitigates against the successful use of a certain clay. Darker clays tend to contain decayed vegetation which is likely to affect the quality and longevity of your paper. You can check the composition of a commercial clay with the supplier, or get a laboratory test done.



4 Continue layering different pulps to build up successive levels within the frame. If you sponge out more water from some areas, you will create an undulating effect.

5 When you have reached the top of the frame, remove it carefully and leave the work to air dry in a cool place.

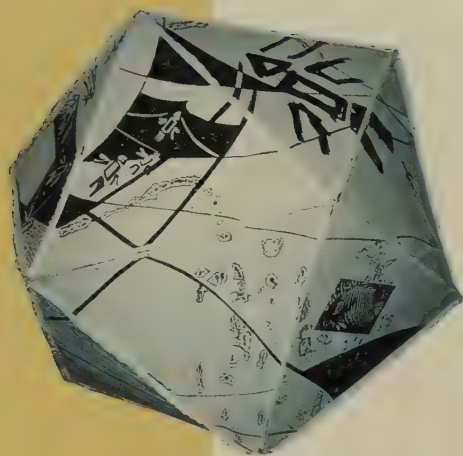


6 You can use a ceramic tool called a slab cutter to cut through the layers while the pulp is still wet or, once the piece has completely dried, use a bandsaw and fine sandpaper to sand the layers, bringing out the colours and cross-section effect still further.

Laurence Barker:
Untitled. Pulp
painting with
etching. 23×31in
(58×79cm).



Paper and Prints



Richard Royce:
Crystal Traces. Cast
paper with woodcut.
8×8×8ft
(2.4×2.4×2.4m).

Paper is a prerequisite for printing and, as paper was invented in China, it is hardly surprising that the earliest examples of printing are Chinese. How and when printing was invented is uncertain. The use of carved personal seals, or “chops”, is a very old Chinese practice. Small stamped images and ink rubbings taken from stone inscriptions (made possible by the earlier introduction of paper) during the Han dynasty (206 BC–AD 220) may have provided the impetus for the development of printing and with it the duplication of official texts and devotional images.

Many of the earliest surviving Chinese prints and manuscripts are religious. Printed prayer sheets bearing texts and depictions of Buddhist deities were produced from single, evenly textured carved woodblocks. The uncut surface of the block was covered with ink and the

image or text transferred onto a sheet of paper. The print thus obtained — where the image is printed from the surface of the block and the background is cut away — is a relief print. It is one of four basic methods of printmaking, along with lithography, intaglio and screen-printing.

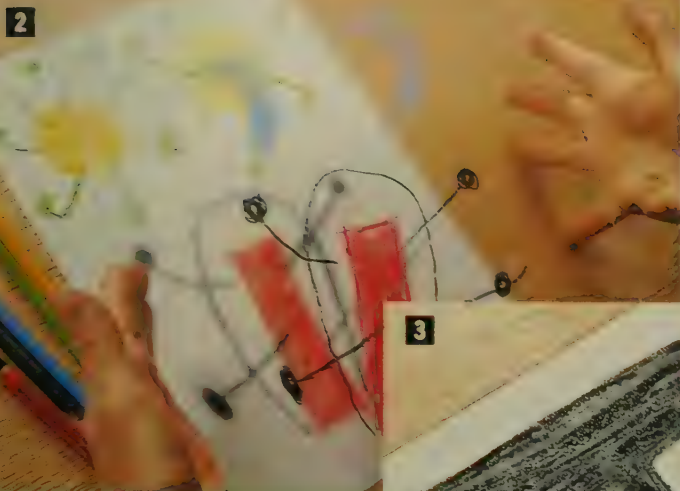
The essence of printing is duplication, and printmaking techniques are mostly employed to make a number of identical copies from a single block or plate. A “monotype”, however, is a unique print which cannot be reproduced, and the term is applied to any print process which does not allow for duplication.

The development of rigid surfaces other than wood or metal — masonite and acrylics, for example — offers a range of experimental printing matrices for the modern printmaker to work with and it is, of course, possible to print an ►

PROJECT

Monotype print

1 Here, a thin sheet of perspex has been chosen as both a drawing and drying surface.



2 You can trace a drawing onto the perspex before the transfer to paper.



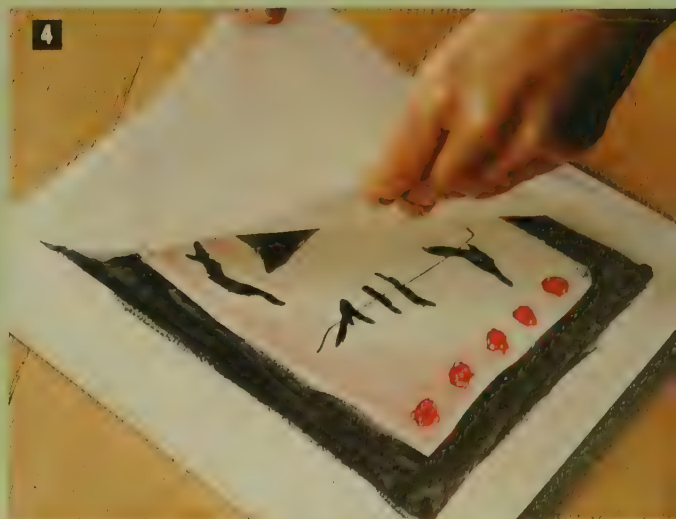
3 Or, you can draw directly onto a Formica surface with water-based crayons and coloured pencils, and use a dampened brush to create washes of colour. Sumi inks, dry pigments, metallic powders and watercolours will all create subtle marks and modulations of tone.

YOU WILL NEED

- selection of handmade papers (as recommended)
- formica covered board or plexiglass (perspex)
- water-based crayons
- coloured pencils (Caran d'Ache)
- sumi ink (optional)
- aqueous dispersed and dry pigments (optional)
- couching felt
- rolling pin

4 Try using plain sheets of paper made from a low-shrinkage pulp to begin with. A light sizing will prevent the water-based media from bleeding too far into the paper. The amount of water in

the sheet and the degree of wetness of the plate surface will also affect the clarity and transfer of the image. Take a pressed, freshly made sheet and place it carefully over the monotype.



◀ image without the use of a traditional printing press.

MATCHING PAPER AND PRINT

The choice of paper and the success of any drawing or print process are also clearly related. Artists have often looked for specific papers for specific prints: the paper often becomes an integral part of the image rather than an anonymous supporting surface. Handmade sheets offer a tremendous range of possibilities in the monotype process, where uniformity is not an issue.

The kind of fibre, the weight of the paper, whether or not the sheet has been

pressed, how damp it is, and the type and amount of size used are all contributing factors. Using experimental watermarks, laminating translucent or coloured shaped pieces of paper to a base sheet, or pulp painting onto a sheet before it is applied to a drawing will enhance the final appearance of the print.



James Rosenquist:
Space Dust.
62½ × 104½ in
(158 × 265 cm).



5 Cover the back of the paper with a clean felt and press the sheet firmly and evenly against the Formica with a heavy rolling pin. Correct pressure keeps the

paper from lifting prematurely, so that it receives the entire image as it dries, without allowing the drawing to bleed into the sheet or distorting the image.

6 Remove the felt, which will have absorbed some of the water from the paper, and leave the sheet to dry on the Formica. A

heavier or larger sheet, or a multi-laminated one, may need to be restrained around the edges during drying.



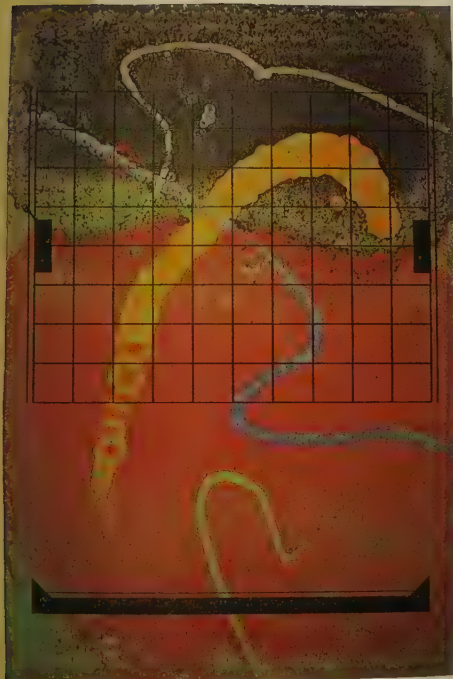
7 When the paper is completely dry, lift it off carefully. The “ghost” drawing left on the Formica can be reworked and used in a subsequent monotype.

Gallery



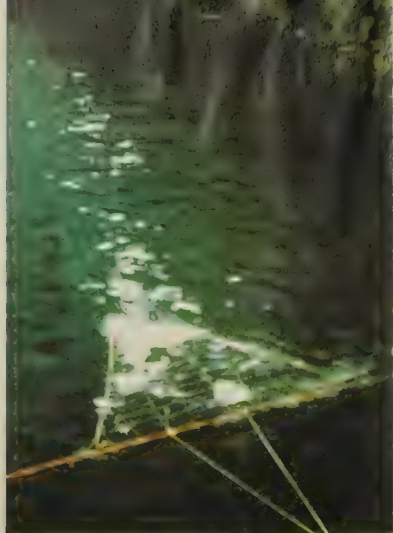
*Alan Shields: Polar
Route. Relief,
screenprint, woodcut.
47in (119cm) diam.*

*Peter Gentenaar:
Blue Note. Etching
(without press) on
linen paper. 20×
25½in (50×65cm).*



*Laurence Barker:
Black Diode.
Etching on
handmade paper.
40½×27in
(103×68cm).*



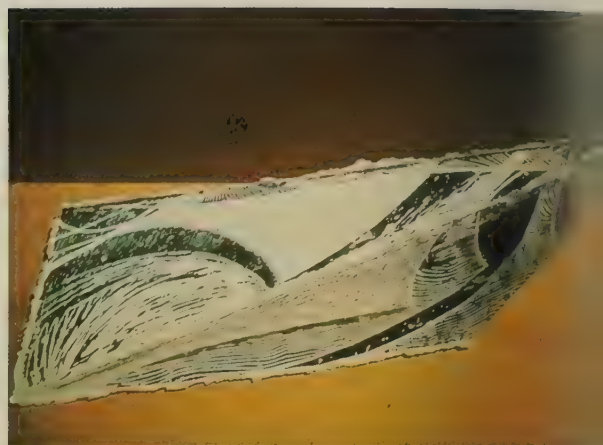


Helmut Frerick:
River-Action Paper
(in memento mori).
A symbolic
enactment of the
transitory nature of
paper as a handmade
paper triangle, 29ft
(9m) in size, is
sacrificed to a
torrential river.



Puck Bramlage:
Secret Life. Amate
paper, Japanese silk
paper, twigs, feathers

Richard Royce:
Fragments of a Lost
Civilization. Cast
paper woodcut.
4 / 2 / 1 1/2 ft
(1.2 / 0.6 / 0.4m).



Anne Vilsboll:
Domino. Handmade
paper, plexiglass.



Margaret Ahrens
Sahlstrand, Jans'
Dress. Cast paper,
oil painting.



Ruth Millar: Book
Nest. Handmade
paper, 6 x 5 x 3 in
(15 x 13 x 8 cm).



ABACA Also called Manila hemp, a plant (*Musa textilis*) related to the banana and primarily cultivated in the Philippines. The leaf stems provide exceptionally strong fibres that make a versatile all-purpose papermaking pulp.

ALKALI A caustic substance used in **COOKING** plant fibres to remove gums, waxes, starch and other non-cellulose materials.

ALUM A complex salt (most commonly aluminium sulphate), used in the sizing of paper. Usually makes paper acidic and is therefore best avoided.

AMATE (AMATL) A pounded bark paper, similar to **TAPA**, originally using the inner bark of fig trees.

ASP (HORN) A notched piece of wood fitted into a platform across the vat against which the mould is placed for a moment to drain before couching.

BAGASSE Grass fibre from the stem of the sugar cane (*Saccharum officinarum*).

BAMBOO Grass fibre from the stem of the bamboo plant (*Phyllostachys aurea*), used for papermaking by the Chinese.

BAST Fibre derived from the inner bark of numerous shrubs and trees, including **GAMPI** and **KOZO**. The term also refers to herbaceous basts, such as **FLAX** and **HEMP**.

BEATING Separating and macerating fibres into pulp for sheet formation, done by hand or mechanical beater. See **HOLLANDER**.

BLEACHING A process used to purify and whiten pulp, usually done with chlorine compounds.

BLEED The spread or feathering of ink or colour within a sheet of paper.

BONDING The capacity of cellulose fibres to adhere and combine. **FIBRILLATION**, **HYDRATION**, **HEATING** and drying promote bonding.

BUFFER (alkaline reserve) An alkaline substance (usually **CALCIUM CARBONATE** or magnesium carbonate) that helps protect paper from acidity in the environment.

CALCIUM CARBONATE Used primarily to promote longevity in paper (see **BUFFER**). In larger amounts it acts as a filler to retard shrinkage in paper casting, and in sheetforming to improve opacity and whiteness.

CALENDERING A pressing process used to impart a smooth or glazed finish to a sheet of paper.

CELLULOSE The chief component of plant tissue, which provides the basic substance for paper manufacture in the form of **FIBRE**.

CHAIN LINES The widely spaced lines created by the retaining wires of a **LAIID MOULD** and visible in the resulting paper.

CHINA CLAY (kaolin) A fine white powder that can be added to pulp as a filler and gives a smooth surface to the paper.

CMC See **METHYLCELLULOSE**.

COCKLING Surface undulation or wavy edges, usually due to uneven drying.

CODEX Manuscript volume, especially of a religious or classical text.

COLLAGE The pasting together of various materials to create an image.

COLLOGRAPH A relief or **INTAGLIO** process using a plate built up by collage.

COOKING The treatment of raw fibres to promote separation, remove contaminants, and dissolve unwanted plant material, usually achieved by heating in an alkaline solution.

COTTON The soft white filaments attached to the seeds of the cotton plant (*Gossypium*) that are one of the main fibres in Western hand papermaking.

COTTON LINTERS The pulp produced from the shorter seed hairs of the cotton plant which has been cooked, bleached, beaten and made into compressed sheets.

COTTON RAG A long-fibred pulp made from new rag cuttings.

COUCHING Transferring a freshly made sheet of paper from the **MOULD** surface onto a dampened **FELT** (Western papermaking) or directly onto the previously couched sheet (Japanese papermaking).

CUTTING An optional function of beating used to shorten the fibres.

DECKLE The removable frame which fits on and around the **MOULD** cover to contain the pulp and determine the size of the sheet.

DECKLE EDGE The distinctive, slightly ragged edge of a sheet of handmade paper, created by a small amount of pulp seeping under the **DECKLE** during formation.

DYES Soluble colouring agents which penetrate the structure of a fibre and become attached to it.

EMBEDDING Incorporating materials in a sheet of paper, so that the fibres hold the embedded material in place.

EMBOSSING The creation of a raised or depressed surface design in a sheet of paper.

FELT The woven, woollen blanket onto which a newly formed sheet of paper is transferred, or couched, in traditional Western hand papermaking.

FERMENTATION Traditional method of loosening and softening cloth fibres prior to **BEATING** by leaving piles of wet rags to heat up and begin to rot. Also, the preliminary separation of plant fibres by soaking in alkaline solution or water, known as retting.

FIBRE The slender, threadlike structure in plant tissue from which papermaking pulp is made.

FIBRILLATION The action of breaking up the surface of individual cellulose fibres during beating.

FILIGRANE (filigree) Ornamental work of fine wire formed into delicate tracery. See **WATERMARK**.

FILLER A general term for materials added to the pulp during beating to give the finished sheet a smoother, whiter or more opaque appearance by occupying some of the spaces between the fibres.

FINISH The surface qualities of a sheet of paper.

FLAX A bast fibre from the plant *Linum usitatissimum*, from which linen cloth is made. Pulp from flax fibre or linen rags makes exceptionally strong, translucent paper.

FLOATING MOULD In traditional Nepalese papermaking, a mould which rests on the surface of a vat of water.

FOREEDGE The outer edge of a book, opposite the spine.

FORMATION AID A substance used to separate long-fibred pulps and control drainage during sheetforming. See **NERI**.

FURNISH The various ingredients used in making paper, particularly the fibre or blend of fibres used.

GAMPI A bast fibre from the plant *Wikstroemia diplompha*, used for Japanese handmade paper.

GELATIN A type of size made from animal tissue or bone.

GLAZING The gloss or polish of a sheet of paper and the process by which it is applied. See **HOT-PRESSED**.

GRAIN The orientation of fibres in a sheet of paper.

GUTTER In a book, the inner margins, or the centre fold where two pages meet.

HALF-STUFF Any partially broken or beaten fibre. Further beating is necessary before it can be made into paper.

HEMP A bast fibre plant (*Cannabis sativa*) of high cellulose content, with a long history in Eastern and Western papermaking.

HOLLANDER A machine, invented in Holland in the late 17th century, for the preparation of rags or fibres for papermaking.

HOT-PRESSED (HP) Paper which is glazed by being pressed between hot, polished metal plates or heated metal rollers.

HYDRATION The absorption of water by the bruised fibres during beating.

IKAT Japanese ikat weaving, also known as *kasuri*, is a technique where lengths of yarn are tied and dyed before weaving.

INTAGLIO A method of printmaking in which the image is cut below the surface of the plate.

JUTE A bast fibre from the Asian plant *Corchorus capsularis*, widely used for making sackcloth, bags and cordage.

KAMIKO Japanese non-woven paper cloth.

KAOLIN See **CHINA CLAY**.

KAPOK A hollow, seed-hair fibre from the silk-cotton tree (*Ceiba pentandra*), used to stuff cushions and in padded clothing.

KOZO Japan's most widely used bast fibre, from the paper mulberry tree (*Broussonetia papyrifera*).

LAID LINES The closely spaced lines seen in paper made on a **LAID MOULD**.

LAID MOULD A mould whose cover is made of closely spaced, parallel wires or bamboo strips, held in place by more widely spaced, perpendicular chain wires or threads.

LAMINATING Combining layers of paper by couching one newly formed sheet on top of another to create a single sheet.

LIGNIN A component of plants that rejects water and tends to decrease fibre-to-fibre bonding in paper. It must therefore be removed before papermaking begins.

LINO-BLOCK A means of block printing using linoleum instead of wood. See **WOODBLOCK**.

LITHOGRAPHY A method of printmaking where an image is made on a flat stone or plate using a material that attracts ink, whereas surrounding areas are treated to repel ink.

LYE A strong alkaline solution used to cook fibres.

METHYLCELLULOSE A specially formulated powder that can be used as an adhesive, as a surface size, or to promote fibre-to-fibre bonding and strengthen paper castings.

MITSUMATA Fibre from the shrub *Edgeworthia chrysantha*, a major source for Japanese papermaking.

MONOTYPE (or **monoprint**) A print, or print process, which does not allow duplication.

MORDANT In dyeing, a chemical substance used to fix colours applied to fibres.

MOULD A rectangular wooden frame covered with a sieve-like laid or wove wire surface, used for sheetforming.

NAGASHI-ZUKI Japanese term for the hand papermaking process using lightly beaten bast fibres and **NERU**.

NERI A viscous **FORMATION AID** in Japanese papermaking, usually derived from the roots of the *tororo-aoi* plant, a member of the hibiscus family.

NOT (Not Hot-Pressed) Slightly rough, traditional paper finish, made by pressing damp paper against itself after the first wet press between felts. Also known as cold-pressed.

PACK A pile of damp sheets, separated from the felts after the first pressing. Also, a small stack of paper ready for glazing.

PAPYRUS A laminated writing surface made from the sliced inner pith of the papyrus plant.

PARCHMENT A writing surface prepared from the skins of animals, especially sheep and goats. See **VELLUM**.

pH A term used to denote the degree of acidity or alkalinity of a substance.

PIGMENT Colouring matter in the form of insoluble, finely ground particles, which have no affinity to the material they are colouring and must be used with a **RETENTION AGENT**.

POST The pile of newly formed sheets alternated with couching felts, ready for pressing.

PULP The aqueous mixture of ground-up refined fibrous material, from which paper is made.

QUIRE A set of 25 sheets of paper (originally 24).

RAFFIA Leaf fibre from a Madagascar palm tree (*Raphia ruffia*), used for cloth, hats, brushes and baskets.

RETENTION AGENT A substance formulated to aid the binding of pigments, dyes and other additives to the fibre.

RETTING See **FERMENTATION**.

RICE PAPER The paper-like material made by cutting and pressing the pith of the rice-paper plant (*Tetrapanax papyriferus*).

ROSIN A sizing agent derived from the distillation of turpentine or from the treated gum pine trees.

ROUGH Traditional paper surface imparted by the weave of the felts during the first wet press.

SCREENPRINTING Printmaking achieved by blocking out areas of a screen or mesh and forcing ink or paint through the open areas onto the chosen surface.

SHIFU Japanese woven paper cloth.

SIGNATURE In bookbinding, a section of pages folded out of a sheet of paper. Also, a letter or number on the first page of each folded section to indicate the order of binding.

SISAL A leaf fibre from the tropical plant *Agave*

sisalana, commonly used for cordage.

SIZE A substance added during beating or after drying to make paper more water resistant. Originally a solution of **GELATIN**, gum or starch, now various chemical agents.

SPINE The back edge of a book where the sections are joined together at the folds.

SPUR A group of sheets dried together rather than singly.

STAMPER Early device (based on the action of a pestle and mortar) for reducing papermaking materials to a pulp. Replaced by the **HOLLANDER**.

STUFF Pulp ready for making into paper.

SU See **SUGETA**.

SUGETA The Japanese papermaking mould comprising the *su* (removable, flexible screen) and *keta* (hinged wooden frame).

SUMINAGASHI A Japanese marbling technique.

TAMEZUKI The Japanese term for Western sheetforming.

TAPA Polynesian word for a cloth-like paper usually made from the inner bark of the paper mulberry.

TEMPLATE A pattern, usually of thin board or metal plate, from which a similar design can be made.

ULTRAFELT (US) A strong, non-woven polyester felt. Not recommended as a couching felt.

VACUUM TABLE A system of forming paper using a vacuum process to compress the pulp, usually comprising a perforated table connected to a vacuum chamber.

VAT Container for pulp in which sheets of paper are made.

VELLUM A fine grade of parchment prepared from skin of calf, lamb or kid.

VYLENE (UK) Couching fabric. US: *pellon*.

WARP Threads stretched lengthwise on a loom. See **WEFT**.

WATERLEAF Unsized paper.

WASHI The Japanese term for handmade papers.

WATERMARK (wiremark) A translucent area in a sheet of paper, usually created by attaching a fine wire design to the mould surface.

WEFT Threads woven across the **WARP**.

WIREMARK See **WATERMARK**.

WOODBLOCK Used for woodcuts, where the background is cut away, leaving the linear elements in relief, and for wood engraving, where the lines are incised, leaving the background in relief.

WOVE MOULD Any mould with a woven mesh surface.

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Credits

KEY: T – TOP B – BELOW C – CENTRE L – LEFT R – RIGHT

2 Stuart Baynes/Wookey Hole Papermill; 6 The Mansell Collection; 7 Photo by Julia Manheim/Keith Morris; 8TR Sophie Dawson; 8TL Josephine Tabbert; 8BR ET Archive; 9 Puck Bramlage; 9BR Sophie Dawson; 9BL Sophie Dawson; 10T Ino Paper Museum; 10B Sophie Dawson; 11T Sally Anne Watt; 11B ET Archive; 12T Sally Anne Watt; 12B Sophie Dawson; 13 ET Archive; 14T Sophie Dawson; 14B The Mansell Collection; 15T Alan Shields/Tyler Graphics Ltd; 15C David Hockney/Tyler Graphics Ltd; 15B Photo by Julia Manheim/Ed Barber; 17C Sophie Dawson; 18T Ino Paper Museum; 18B Stuart Baynes/Wookey Hole Papermill; 23T Sophie Dawson; 23B Sophie Dawson; 24T Sophie Dawson; 25T Judith Sugarman; 25B Ino Paper Museum; 26 Moulin à Papier, Richard de Bas; 27 Judith Sugarman; 30T Moulin à Papier, Richard de Bas; 30B Sophie Dawson; 31T Sophie Dawson; 31B Peter Gentenaar-Torley; 34 Sophie Dawson; 36T Thomas Kelly/The Body Shop International; 36B Sophie Dawson; 38T Ino Paper Museum; 38B Stuart Baynes/Wookey Hole Papermills; 39T Kathryn Clark/Twinrocker; 39B The Mansell Collection; 44T Moulin à Papier, Richard de Bas; 44B ET Archive; 45L Sophie Dawson; 45BR Lee S McDonald; 48T Judith Sugarman; 48B Sophie Dawson; 49 Sophie Dawson; 51T Sophie Dawson; 54 Hugh O'Donnell/Tyler Graphics Ltd; 55 Vito Capone; 56T Kathryn Clark/Twinrocker; 56C Peter Sowiski; 56B Therese Weber; 59T Sophie Dawson; 59B Carol S Farrow; 62T Moulin à Papier, Richard de Bas; 62B Quarto Publishing plc; 64T Moulin à Papier, Richard de Bas; 69TR Soledad Vidal Massaguer; 69C Sophie Dawson; 69BR Joan Hall/photo by Hal Bundy, courtesy Elliot Smith Gallery; 72T Meszaros Geza; 72C Julie Norris; 72B Margaret Ahrens Salstrand; 74T Gerry Copp/J Copp; 74C John Gerard; 74B Richard Flavin; 76T John Gerard; 76C Gerry Copp/J Copp; 77T Richard Flavin; 78T Otavio Roth; 80 Papyrus

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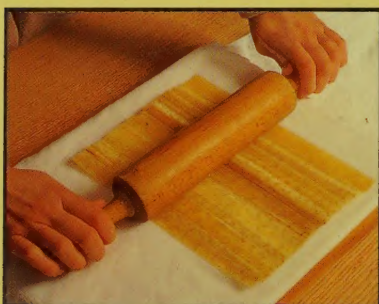
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SOPHIE DAWSON has been making paper for more than ten years, and has lectured widely on the subject. She helped establish a handmade paper mill in the Philippines, teaching the craft while researching the use of new fibres. For five years she co-edited the journal of the International Association of Hand Papermakers and Paper Artists, and she currently serves on its board. Her work has been featured in international exhibitions, and examples may be found in private collections throughout North America and Europe.

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